AVIATION WEEK

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GAS TURBINE IGNITER

GAS TURBINE TAILPIPE THERMOCOUPLE

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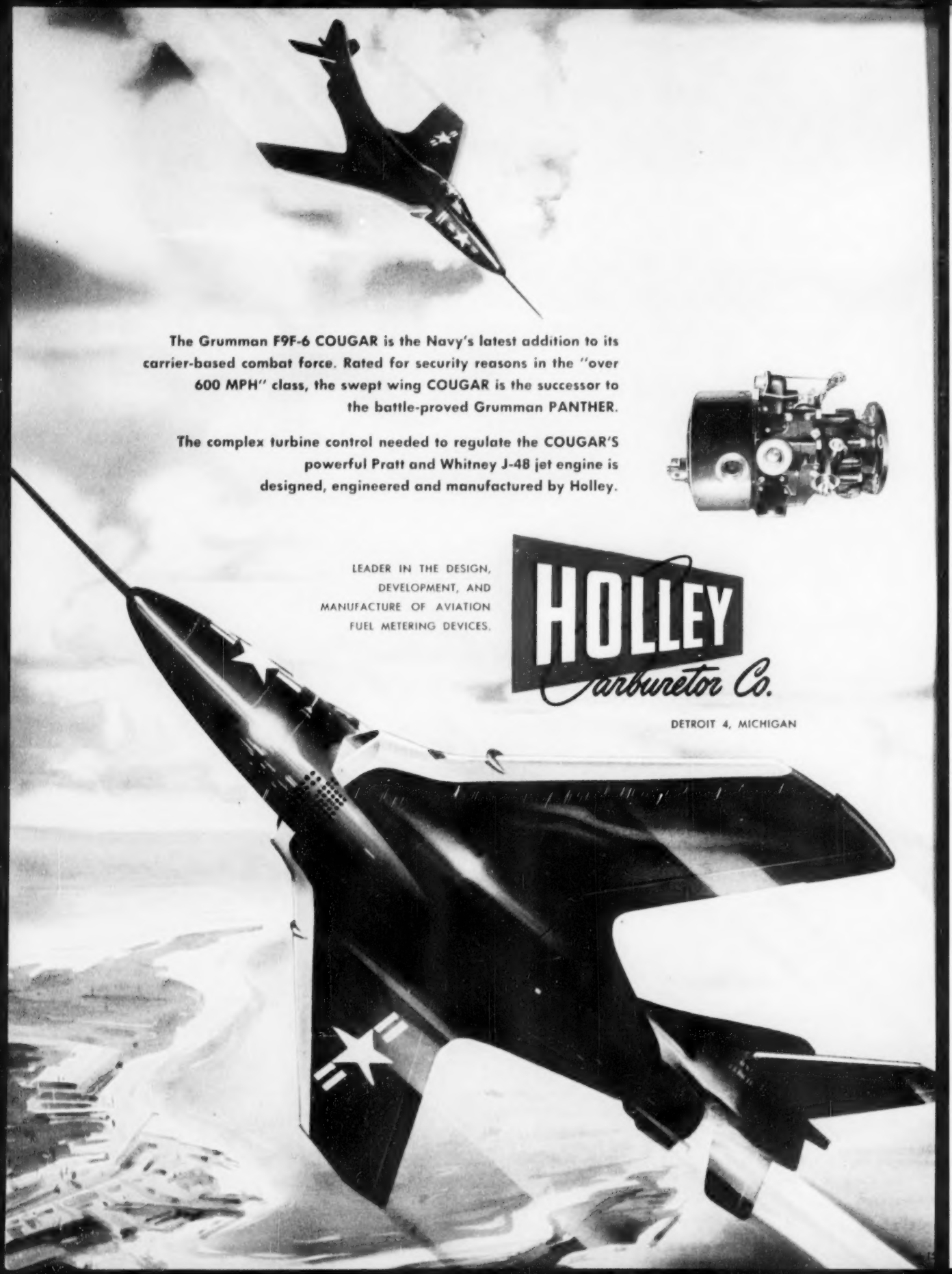

The Grumman F9F-6 COUGAR is the Navy's latest addition to its carrier-based combat force. Rated for security reasons in the "over 600 MPH" class, the swept wing COUGAR is the successor to the battle-proved Grumman PANTHER.

The complex turbine control needed to regulate the COUGAR'S powerful Pratt and Whitney J-48 jet engine is designed, engineered and manufactured by Holley.

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G-E silicone rubber now replaces asbestos gaskets in chemical kettles like this.

Fused-glass electrical connections in this washing machine have been supplanted by G-E silicone rubber.

G-E silicone rubber replaces silver solder seams in this steam iron.

Have you a materials problem? Perhaps you're presently using materials such as glass, asbestos, solder, mica or graphite to join, resist chemical attack or insulate an assembly—particularly at high or low temperatures. But, could you reduce replacement or assembly costs, improve the design or lengthen the life of your product if these common materials were *resilient?*

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9/16" and 1" sleeves only, without springs, are also available

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1043 Silicone
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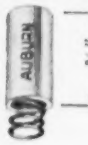
for military trucks and tanks



for 5 mm cable
SP420 Steatite
CC4025 Mycalex
CC4006 Alumina

for 5 mm cable
CC4017 Steatite
CC4020 Mycalex
CC4013 Alumina

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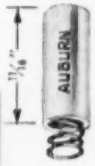

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Used with all 11/16" connectors on 5 mm cable

AD50-894
Used with all 9/16" connectors on 5 mm cable

AA50-313
Spring Assembly
Used with all 9/16" and 11/16" connectors for 5 mm cable

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Aviation Week

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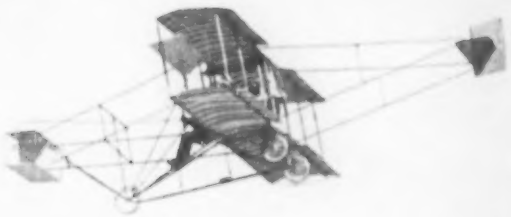
The Navy Learns to Fly—

1911



In June of 1911 Lieut. John H. Towers (left) and Lieut. T. H. Ellyson (right) were ordered to Hammondsport, N. Y. to be taught to fly at Glenn Curtiss' flying school. They were the Navy's first two air pilots, and subsequently both were to rise high in the ranks of the naval air service.

● Our nation's naval air arm has come a long way since the days when the young Lieutenants Towers and Ellyson learned to fly.

And through the years, these great advances in aeronautical engineering have been matched by equally important developments in aviation fuels.

Phillips Petroleum Company, a pioneer in the development of fuels for all ranges of flight, is today one of the country's largest suppliers of aviation gasolines for commercial, military and private use. Phillips is always ready with new fuels for the very latest developments in turbo-props and jets . . . in addition to supplying great quantities of 115/145 grade aviation gasoline.

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1953

The Naval Air Cadet's first landing on an aircraft carrier marks his promotion from cadet to full-fledged naval aviator. Here the pilot of a U. S. Navy Skyraider receives instructions for landing aboard the U.S.S. Tarawa.

Phillips 66

AVIATION PRODUCTS

1903 50TH ANNIVERSARY OF THE AIRPLANE 1953

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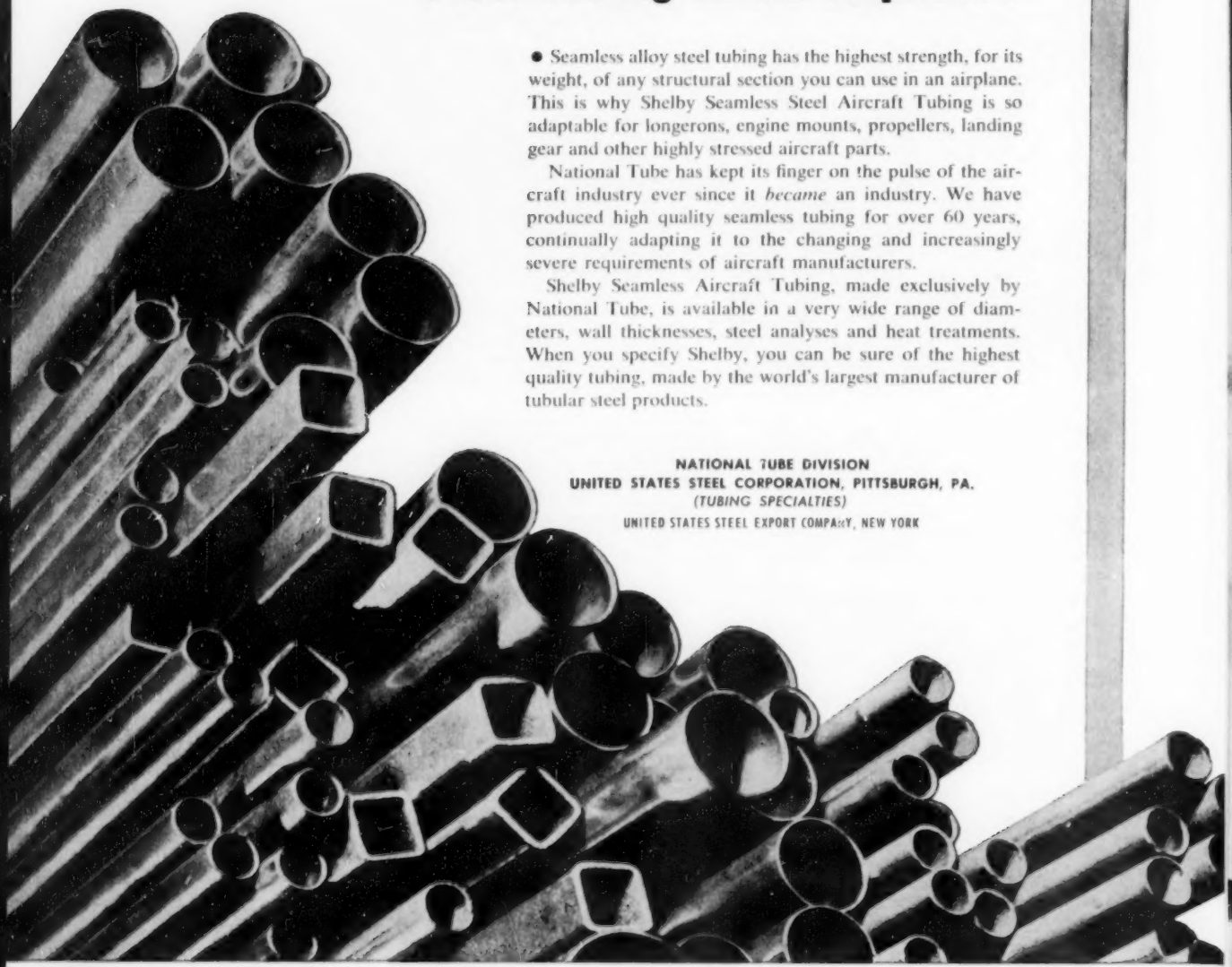
do they use SEAMLESS steel tubing in an airplane?



• Seamless alloy steel tubing has the highest strength, for its weight, of any structural section you can use in an airplane. This is why Shelby Seamless Steel Aircraft Tubing is so adaptable for longerons, engine mounts, propellers, landing gear and other highly stressed aircraft parts.

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NEWS DIGEST

Domestic

Senate confirmation was expected promptly last week of President Eisenhower's nomination of Frederick B. Lee as Civil Aeronautics administrator and of Hamar Denny as member of Civil Aeronautics Board. (Appointments of these two men was forecast in AVIATION WEEK Feb. 23, p. 7).

James Henderson Douglas, Jr., World War II chief of staff of the Air Transport Command, has been sworn in as Undersecretary of Air Force.

Proposed merger of Temco Aircraft Corp. and its subsidiary, Luscombe Airplane Corp., will be voted on by stockholders at two meetings Apr. 2 in Dallas. The agreement calls for exchange of three shares of Luscombe stock for one share of Temco. Merger is proposed because of the economy possible in operation of Luscombe as a Temco division.

Contracts totaling $26 million for jet engine power packages and airframe components have been awarded by Boeing to Rohr Aircraft Corp., pushing the Chula Vista, Calif., firm's backlog to $185 million. Another Boeing subcontract of a "sizable" amount for flaps and control surfaces is announced by Twin Coach Aviation Division, Buffalo, N. Y.

Aircraft Service Assn. is pooling industry-wide facilities and experience to assist the armed forces in attaining "efficiency, economy and safety . . . for greater national defense." Officers of the new organization: Thomas Wolfe, Pacific Airmotive Corp., president; Robert McCulloch, Temco, vice president, and Max Balfour, Spartan Aircraft, secretary-treasurer.

Operational record in the Far East of 2,000 flying hours has been set by a Fairchild C-119 Flying Boxcar attached to a USAF squadron based in Japan.

J. W. Miller, former independent airplane manufacturer and retired engineering professor, died Feb. 26.

Air Transport Assn. seminar on Constellation airliners will be held Mar. 24-26 for engineering and maintenance personnel from 15 airlines at Lockheed's Burbank, Calif., plant.

Helicopter design will be taught by Stanford University's Division of Aeronautical Engineering in classes scheduled to start during the spring quarter.

CIVIL PRODUCTION of new Hiller 12-B three-place helicopters, like the one pictured above, started early this month. List price is $36,000. Fulfillment of military orders on schedule make it possible for the Palo Alto, Calif., concern to offer "quick delivery." The 12-B is similar to the U. S. Army H-23B and is powered by a 200-hp. Franklin engine. Standard equipment includes dual controls, avionic trim controls, fully enclosed cockpit and skid landing gear. The new schedules represent Hiller's first large-scale copter production since start of Korean war.

Aeronautical Engineering scholarship for two years of study at Georgia Institute of Technology has been set up by Hawthorne School of Aeronautics, Moultrie, Ga.

Slick Airways has joined the Flight Safety Foundation, boosting the organization's membership to more than 20 airlines and 3,000 pilots.

Lane Aviation Co., Columbus O., and Lynch Flying Service, Billings, Mont., have been granted licenses to fly chartered planes from their home airports to limited areas in Canada.

Financial

Flying Tiger Line predicts gross revenues of more than $25 million for the year ending June 30, compared with last year's $22 million.

Solar Aircraft Co., reports total sales of $51,552,800 for nine months to Jan. 31, a 42% increase over the same period a year earlier. Net income was $2,188,400.

Ryan Aeronautical Co. reports sales totaling $9,886,180 during the three-month period ending Jan. 31, producing a net profit of $381,217 after taxes.

Doman Helicopters' authorized capitalization has been increased by stockholders from 600,000 to one million shares.

Boeing Airplane Co., Seattle, earned a net of $10,167,366 during the first nine months of 1952, compared to $17,140,751 for all of 1951. The company has declared a $1 per share dividend to 14,500 stockholders of record, a total payment of $1,642,000.

International

Pieter J. C. Vos, managing director of Fokker Aircraft Co., died Feb. 23 in Amsterdam.

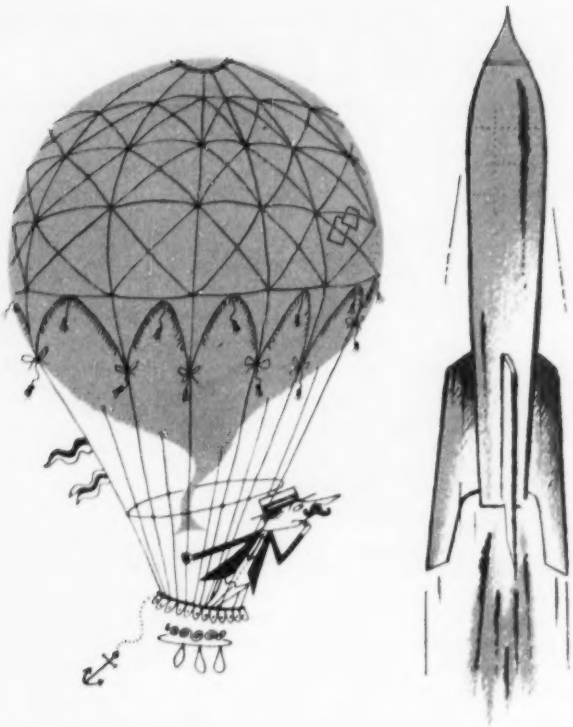
Italy's Fiat Spa Corp. has been granted a $9-million USAF contract for J35 spare parts.

Portuguese air cadets will arrive this week in Canada for training at North Atlantic Treaty Organization bases set up by the Canadian government.

Canada's Department of Defense ordered aircraft frames and equipment totaling $8,219,000 during the first six weeks of 1953.

West Germany's new airline is named Luftverkehrsbedarfsgesellschaft Ag (Air Transport Equipment Co. Ltd.).

Scandinavian Airlines System—operated jointly by Sweden, Norway and Denmark—reports receipts last year totaled $184 million.



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- *Needles always uniform.*
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- *One piece construction.*
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- *Sturdier, last longer.*
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The Aviation Week

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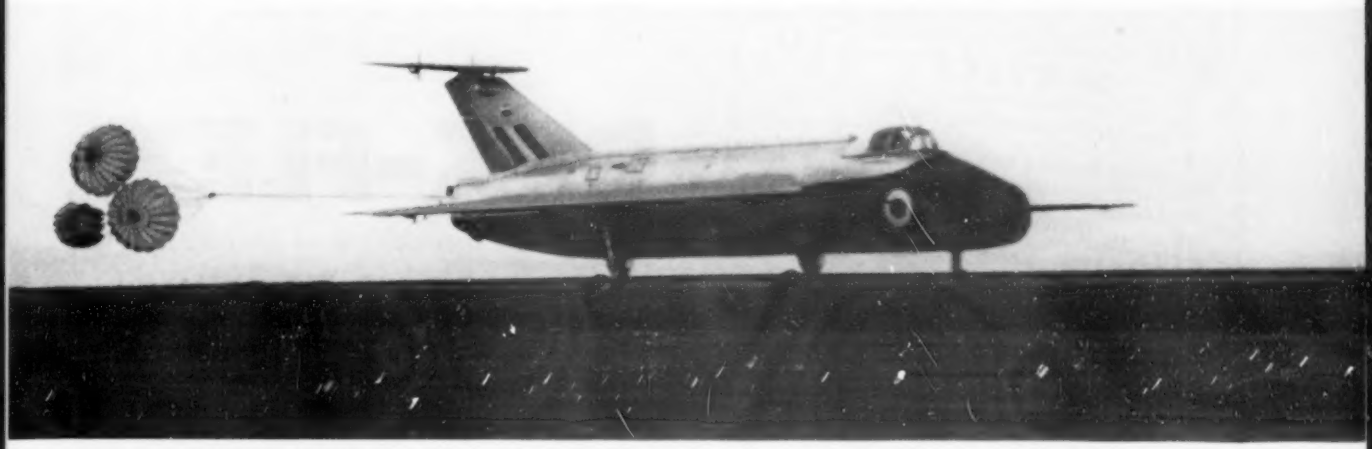
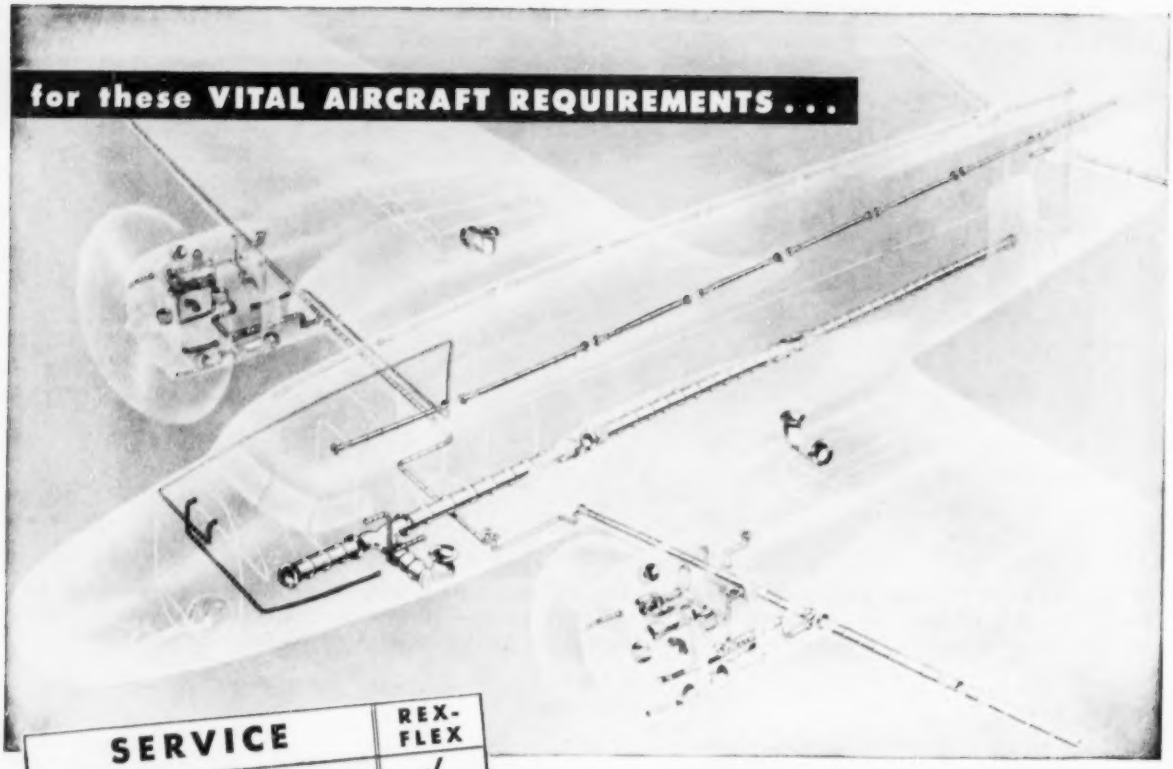
NEW BELL COPTER FLOWN—Initial photograph of the new Bell XHSL-1 anti-submarine warfare tandem copter which was flown for the first time at Fort Worth, Tex., Mar. 5. Photo has been extensively retouched. Craft is powered by a 1,900-hp. P&WA R2800 mounted just forward of the tail. Considerable avionics gear is carried in the XHSL-1's long, narrow fuselage.



CHUTES FOR SHORT LANDING—Short S.B. 5 variable-sweeping wing research plane is seen using a trio of small parachutes to brake its landing run during a test. The craft is being used to investigate lowspeed flight phenomena with wings swept 50, 60 and 69 deg. Wingsweep is varied on the ground. Fixed landing gear also can be adjusted in accordance with different wing positions.

New Aircraft In the News

VIN-NAVION DELIVERY—Miami bank executive od Bassett (left) accepts delivery of his new Twin-vion business plane from Jack Riley, president of ey Aircraft Co., Ft. Lauderdale, Fla. The twin-gine lightplane has attracted considerable attention. nco Aircraft Corp. is slated to build 100 Twin-vions at Greenville, Tex., under contract from Riley. vered by two 150-hp. Lycomings, top speed is 178 h. Gross weight is 2,950 lb.



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Fuel filler necks and vents	✓
Generator blast tubes	✓
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Drain lines	✓
Exhaust lines	✓
Carburetor air intake	✓
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WHO'S WHERE

In the Front Office

John K. Northrop, former president of Northrop Aircraft, Inc., has been retained by Garrett Corp., Los Angeles, as part-time consultant to president **J. C. Garrett.**

Kenneth L. Burroughs has been elected president of Aeronautical University, Chicago.

Virgil W. Hackett is president of Executive Aircraft Co., Kansas City, Mo. Other officers of the new airplane service and repair firm are **Lee Florence,** vice president; **Louis S. Bishop,** secretary, and **Paul Campbell,** service manager.

Dawson J. Burns, consultant to Sperry Corp., has been named president of Wheeler Insulated Wire Co., Waterbury, Conn.

Lawrence A. Hyland has been elected vice president-engineering of Bendix Aviation Corp., Detroit.

Delmond L. Getz is the new vice president-engineering of Steel Products Engineering Co., Springfield, Ohio.

P. N. Jansen has been appointed special assistant to the senior vice president of Boeing Airplane Co., Seattle. New staff engineers in Boeing's recently formed systems-analysis unit are **William H. Cook, H. W. Withington, H. J. Longfelder** and **R. G. Christensen.**

William Maxfield has been named assistant to the vice president-aircraft and engines, Braniff Airways, Inc.

Changes

James H. Stebbins, vice president of W. R. Grace & Co., has been elected a director of Pan American-Grace Airways.

W. L. Walker has been named treasurer of Alaska Airlines.

R. M. Hollingshead Jr. has been elected a member of the board of directors, Kellett Aircraft Corp., Camden, N. J.

Roy J. Benecchi has been appointed assistant secretary of Lear, Inc., Grand Rapids, Mich.

L. M. Greening, former president of Seattle Air Freight, Inc., is air cargo sales manager for Pacific Northern Airlines.

Gilmer C. Buschardt has been named chief engineer of Pioneer Air Lines.

C. C. Shafer has been appointed chief plant and industrial engineer, Chase Aircraft Co., West Trenton, N. J.

James Rustad has been promoted from chief engineer to purchasing agent of Bonanza Air Lines.

Honors and Elections

Don L. Walter, engineering-manufacturing director of Marquardt Aircraft Co., Van Nuys, Calif., and Marquardt engineers **John A. Drake** and **James C. Wise** have been reappointed to technical committees of the NACA.

Mark Mills, consultant to North American Aviation's atomic research department, has been appointed to the scientific advisory board of the U. S. Air Force.

INDUSTRY OBSERVER

► **Despite a growing backlog of British jet transport orders, there is likely to be further airline buying of Douglas, Lockheed and Convair piston-powered transports before the first orders are placed for an American-designed jet transport.**

► Allison is preparing to flight test its J71 turbojet in a B-45 flying test bed after successful 200 hr. of running in NACA's altitude test chamber at Cleveland. The 9,500-lb.-thrust jet faces a good production future as the powerplant for McDonnell-built Demon (F3H) Navy fighters and Douglas RB-66 and B-66 bomber types. The J71 also will power an advanced version of the Northrop F-89 and the Republic F-105.

► **Advanced development of the Allison turboprop series is scheduled to produce the T56, a single power unit rated at 3,750 eshp., and the T54, a double T56 unit coupled to a single set of propellers to produce 7,500 eshp. T54 will be used in the experimental Republic F-84H while the T56 is being considered for larger versions of the Lockheed C-130 transport now earmarked for the 2,750-eshp Allison T38.**

► Look for Northrop's newly reorganized engineering staff headed by Edgar Schmued, designer of the North American Mustang and Sabre, to come up with a transonic deltawing fighter design. Schmued is a strong exponent of the delta design.

► **First Lockheed F-94C Starfires have been delivered to a USAF combat group. They are replacing earlier F-94 models in the all-weather interceptor wing at Otis AFB on Cape Cod.**

► Three Sikorsky H-19 Army helicopters will serve as aerial trucks in the latest Nevada atomic bomb tests, hauling television equipment onto mountain positions to set up a network to transmit the atomic maneuvers to a nationwide audience. Marines will also use Sikorsky HRS copters in the first assault maneuvers under atomic conditions.

► **Navy planners who are enthusiastc about aerial refueling operations for carrier-based aircraft point out that one of the main advantages will be for emergency transfusions to aircraft low on fuel as they return to the carrier from combat missions. Under present conditions fuel-starved jets making emergency landing or ditching disrupt normal carrier landing operations and are a tough operational problem.**

► Vickers-Armstrongs now state that their Supermarine Swift fighter has flown above the speed of sound several times, but do not indicate if transonic flight was achieved in level flight or a dive. The Swift, recently rejected by USAF after evaluation for off-shore procurement with MSA funds, is scheduled for squadron service with the Royal Air Force this summer.

► **Canadian Pacific Comet 1A crash at Karachi will make it difficult for the airline to operate its planned trans-Pacific service this spring. CPA has one other Comet on order. Only chance of getting more model 1As appears to be from RCAF which has two Comet 1As on order for delivery sometime later this year. DeHavilland will build a total of 21 Comet 1As.**

► Latest check on the off-shore aircraft procurement program indicates a $60-million contract for the Hawker Hunter, $86 million for the Dassault Mystere IV, and $70 million additional to be spent as "defense support" for the European aircraft industry. Best bet for the latter fund still is the Gloster Javelin built under license in Italy to meet the all-weather NATO requirement. Brig. Gen. Al Boyd, USAF chief test pilot, is en route to England for further flight tests of the Javelin.

► **De Havilland DH-110 night fighter again is being considered for a small RAF order—possibly 25 aircraft. De Havilland is pushing the plane for export sales.**

AVIATION WEEK

VOL. 58, NO. 11

MARCH 16, 1953

New Low Fares Signal . . .

Boom for Trans-Atlantic Aircoach Travel

- **Half-million passengers expected during 1953.**
- **Tours and Europe coach service new attractions.**

By Lee Moore

The greatest boom in trans-Atlantic travel history starts Apr. 1 when new low aircoach fares go into effect.

Most trans-Atlantic flights already are booked solid from April through July for Pan American, Trans World Airlines and many foreign flag lines.

The airlines are juggling schedules frantically, trying to get extra flights for the peak summer season.

Here are the early developments:

• **A half-million air travelers** will cross the Atlantic to and from Europe in 1953, TWA predicts. This will double the average volume of pre-coach years.

• **Most airlines** have increased coach schedules 10 to 50% over last summer.

• **Inauguration of European aircoach** will cut Europe and Near East fares 10 to 25%.

• **All-expense tours** sold by airlines and travel agents at rates as low as $10 a day are just beginning to stimulate future planning by many of the 50 million cost-conscious vacationists in the U. S.

• **Queen Elizabeth's coronation** slated for June 2 has trans-Atlantic flights booked solid in May and June.

• **CAB delayed approval** of the new cartel-fare agreements of the International Air Transport Assn. until last week. This has cramped advertising and confused some scheduling and ticketing, but the effect will not be bad because of the heavy consumer demand for April and May travel.

► **Serve Meals**—This is only the second year of trans-Atlantic coach rates and the first year of coach fares within Europe and the Near East. It is this new fare structure that CAB delayed approving—allegedly because the airlines refused to show CAB the detailed resolutions and explanations of the IATA fare conferences and final agreements.

The new Atlantic rates will be $5 higher than last year, to pay for free-meal service, which was not provided last year. Airlines say that offering meals for sale in the air caused considerable waste, since they could seldom predict just how many meals would be bought.

The intra-European coach fares will be 10 to 25% lower than first-class, but still much higher than those in the U. S. Europe coach fares will average 8 to 10 cents a passenger-mile, compared with the 7-cent trans-Atlantic coach rate and 4 to 4½ cents a mile on U. S. coach routes. First-class European rates are 10 to 12 cents a mile, compared with 10 cents trans-Atlantic and 6 cents in the U. S.

► **CAB View**—CAB approved the trans-Atlantic coach fare boost and the European coach fare cut. CAB had hoped the Europeans would cut coach fares considerably more. They are still much higher than first-class fares in the U. S., but the Board takes the position that this is Europe's business and the U. S. should not interfere.

The Board opinion, issued last week, expresses strong disapproval of the way the IATA cartel agreements were made. The Board therefore refused to give approval for nearly three months—from Jan. 1 until last week—waiting for TWA and Pan American to submit detailed explanations of how and why IATA made these agreements.

The IATA resolutions are so complex that Board members and the CAB staff say they still do not understand a large part of them, but approved them anyway to permit European coach fares to take effect Apr. 1.

The Board also points out that in approving the U. S. carriers' membership in IATA May 1, last year, CAB insisted that the airlines submit all future data and minutes of meetings for its inspection. This is because Board approval of the fare agreements gives the airlines immunity from U. S. anti-trust laws. "How can we grant this immunity," a CAB official asked, "if we don't know what the agreements are?"

► **CAB Objects**—The Board opinion last week also strongly criticized two other characteristics of the agreements:

• Making all resolutions interlocking, so governments cannot disapprove one without nullifying all.

• Granting special privileges and exceptions to individual airlines.

For instance, the new IATA resolutions permit Italy to operate first-class low-density seating DC-6s at coach fares. Reason Italy insisted on this is that it has too few planes to split up its fleet with two types of seating. Another example of a special grant is an extra-free baggage allowance for Egyptian and Greek airlines. They asked this

Coach Booms International Growth

(TWA International and Pan American Atlantic Division 1951-52)

Revenue passenger-miles: (in thousands)			
Summer half (Apr.-Sept.)	**Coach**	**First-class**	**Total**
1951*	15,466	479,679	495,145
1952	224,011	400,249	624,260
Winter quarter (Oct.-Dec.)			
1951*	4,439	201,302	205,741
1952	90,112	156,952	247,064
Load factors:			
Summer half	**Coach**	**First-class**	**Overall**
1951*	84%	68%	68%
1952	75%	69%	71%
Winter quarter			
1951*	60%	63%	63%
1952	58%	59%	59%

* 1951 coach is Bermuda service of Pan American only. Trans-Atlantic coach of TWA and PAA started May 1, 1952, increasing trans-Atlantic volume 50% and total Atlantic, Europe and Near East service (which then had no coach rates) by 26%.

SOURCE: Form 41 reports of carriers to CAB.

concession as an extra inducement to passengers to offset the sales disadvantage of these airlines' comparatively obsolescent equipment.

▶ **Delays "Emigrant" Fare**—CAB deferred decision on the Pacific fares submitted by IATA because they included a special "emigrant" fare which the Board considers discriminatory—a special privilege in the form of price concession to emigrants. The $500 Hong Kong-San Francisco emigrant fare compares with a $726 regular fare. But the Board said this is a legal objection.

The Board says it is "fully cognizant of the desirability of facilitating emigrant traffic," but adds that the service should be furnished through legal procedure, such as government charter to fly at the proposed reduced fares.

▶ **Tour Promotion**—Package tours may do more to increase European travel than any move since the basic trans-Atlantic fare cut of last year. The various tours offered by airlines and agents can greatly lower the living and sightseeing expenses of even the most frugal traveler.

For instance, KLM's "Thrifty Dutchman Tour" costs $10 a day, including all essentials—room, board, tips, intercity transportation and sightseeing. The tour offers 10 days in any European country or area for $100 total.

Combinations of these tours afford further flexibility at modest additional cost. The free stopover privilege allows a traveler to make one or a combination of these tours and then move on to other European cities at his own living expense but at no additional air transportation cost. If a tourist is making his way back westward through Europe to the U. S. from an Italian tour, he can stop over in Paris, London and Shannon on his return air ticket at no additional cost.

▶ **Airlines' Outlook**—Pan American and TWA are not predicting how much their business will increase this year over last, but both carriers told AVIATION WEEK they expect substantial gains.

Here is a rundown on summer plans of some major trans-Atlantic lines.

• **Pan American** plans to schedule at least 11 coach and 18 first-class flights per week across the Atlantic. Last summer's coach service started at seven flights a week and finished with 14.

PAA's DC-6B coaches seat up to 85 passengers, but the company generally confirms advance reservations for only 80 seats.

Coach passengers on Pan American, as on many other lines, will get almost everything first-class service offers, including speed and free meals. Schedule time for PAA's DC-6B coach is 13 hr., 15 min., a half hour longer than first-class Stratocruiser service.

The great demand of U. S. travelers for space to Europe around the time of the coronation of Queen Elizabeth led Pan American to require ticketing by Mar. 1 for space from mid-April through June. PAA is asking almost immediate ticket purchase to hold additional seats reserved on these flights, when they are available.

• **TWA** predicts that 60% of its international passenger service this year will be coach, compared with 40% in 1952—the first year of trans-Atlantic coach. TWA recently told CAB that ultimately 80 to 85% of all trans-Atlantic service will be coach. TWA seems to be moving fast toward that goal, with 60% of service already in coach in only its second year.

TWA starts the boom season Apr. 1 by adding six more coach flights per week, making 21 in all compared to 15 a week this winter. The 14 first-class flights bring TWA's summer trans-Atlantic service to 35 flights a week each way.

The carrier has scheduled 21 trans-Atlantic coach flights per week plus 15 first-class. TWA's trans-Atlantic coach-service Constellations are arranged to seat only 59 passengers, compared to Pan American's 80- to 85-seat DC-6Bs. A TWA spokesman told AVIATION WEEK TWA has no plans, at present, for either increasing Constellation seating capacity or obtaining additional equipment.

TWA is requiring a 25% deposit to confirm all coach reservations more than 30 days ahead, and full ticket payment within 30 days of departure for the peak season—May through July eastbound and mid-August through September westbound. Deposits must be made within 15 days after the reservation. Passengers making reservations within 30 days of departure must pick up and pay for their tickets within the week.

• **British Overseas Airways** coach service in 68-seat Connies will increase during April to at least nine flights a week out of New York and another five from Montreal. This compares with six New York and three Montreal last summer.

First-class 55-60 seat Stratocruiser service is scheduled at 11 flights a week from New York and four from Montreal.

BOAC says the only thing that will hold down volume of its coach service this summer will be lack of suitable equipment. The company hopes to be able to schedule a few more than 14 trans-Atlantic flights per week later on by obtaining extra equipment.

All British European Airways service will be coach except the plush "Silver Streak" London-Paris service.

• **Scandinavian Airlines System** will more than double last year's service with 14 coach and six first-class flights per week. SAS operates 60-seat DC-6B coaches and 34-passenger DC-6 first-class planes. Last summer, SAS ran six coach and four first-class flights a week across the Atlantic.

• **Air France** has scheduled eight coach and eight first-class flights per week.

Air France is converting its coach seats to new Comet chairs, which may add a few more seats to the present 59-passenger capacity.

First-class Constellation seating capacity has been boosted from the former super-luxury 34- and 42-seat versions to a standard 44-seat configuration. By mid-summer, the company will have replaced six of its eight first-class Constellation flights with Super Constellations. But the extra room will go to increased luxury rather than seating.

Air France this year will start putting turboprop Vickers Viscounts on intra-European service and later will add jet Comet service on medium haul routes.

• **KLM Royal Dutch Airlines** this summer will increase trans-Atlantic service to nine coach and seven first-class flights per week. Most coaches are 59-seat Constellations, but there will be a few DC-4 flights. Last summer, KLM operated five coach and seven first-class flights per week. First-class flights are in 42-seat DC-6Bs.

The carrier has many trans-Atlantic coach flights sold out through mid-August, and expects business this summer to far surpass last summer's success.

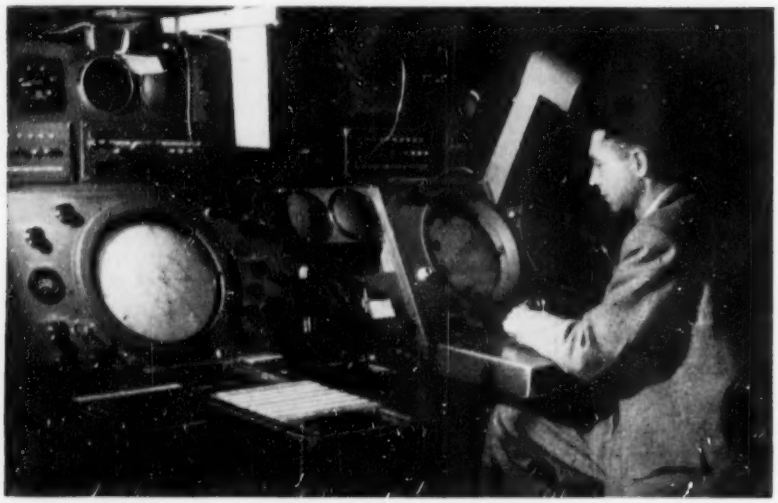
Martin Wins in NWA 2-0-2 Suit

Testimony which stressed that CAA engineers "who are experts in their profession" approved and certified the Martin 2-0-2 apparently tipped the scales in the minds of jurors in favor of Glenn L. Martin Co., defendant in a three-quarter-million-dollar suit brought against it by Northwest Airlines.

The carrier had charged in district federal court, Cleveland, that the manufacturer was negligent in design, material, workmanship and testing of five 2-0-2s it had modified and delivered to NWA. The airline has alleged that because Martin did not use reasonable care in modifying the lower spar caps on the planes, one of the aircraft had crashed during a storm over Wisconsin Aug. 29, 1948, with loss of 30 passengers and three crew members.

Contributing to the juror's decision was testimony that Northwest engineers had consulted, worked with, and assisted Martin in planning and construction of all the planes delivered to the carrier. Also charged during the trial was alleged negligence on part of the pilot for attempting to fly through the intense storm rather than skirt it, although he purportedly had ample opportunity of acquainting himself with the storm's severity.

PLASTIC MARKERS on Skiatron scope spot planes in 100-mi. radar control pattern.



FINAL GUIDANCE from standard approach zones onto ILS is monitored on these scopes.

Radar Breaks Bad-Weather Jams

By Robert Hotz

Radar traffic control at Washington National Airport has developed techniques offering a major improvement in maintaining airline schedules during instrument weather.

As a result of 18 months' preliminary experimenting and six months of full radar traffic control, the following results have been achieved:

- Instrument Flight Rule (IFR) capacity of the airport has doubled.
- Traffic delays due to weather have been cut to one-third of former time.
- "Stacking" has been virtually eliminated.
- Departure delays have been cut from a maximum of 2 hr. to a maximum of 10 min.
- Traffic delays due to missed approaches or lost aircraft have been virtually eliminated.
- Time required to unsnarl traffic jams resulting from sudden development of bad weather forcing wholesale shifts from visual to instrument flight plans has been reduced materially.
- Safety of terminal-area traffic through positive anti-collision control has been increased.

Some radar procedures successfully tested at Washington already are being applied in the New York and Chicago areas. Eventually the Washington radar pattern will be applied to all of the 52 busiest U. S. airports, where Civil Aeronautics Administration plans installation of Airport Surveillance Radar (ASR) and Precision Approach Radar (PAR). In addition, radar approach control techniques will be used at 31 additional airports, where CAA plans only ASR installations. To date, 10 airports—including Washington, New York and Chicago—have been equipped with ASR and PAR.

Although much of the pioneering in radar traffic control was done at Chicago Municipal Airport, Washington National was picked for the initial full-scale operation for three reasons:

- **High density of traffic.** It is the third busiest airport in the country.
- **Complexity of traffic pattern.** The traffic pattern includes operations at Bolling and Andrews Air Force Bases and Anacostia Naval Air Station.
- **Availability of a long-range (100-mi.) search radar** that extended the control area onto the airways converging on Washington.

CAA carried the main burden of the Washington operation with the assistance of a special traffic control committee, which included representatives of Air Transport Assn., Air Line Pilots Assn., Air Force, Navy and Coast Guard. Air Transport Assn. is particularly enthusiastic about the results achieved with Washington radar control on scheduled airline operations.

ATA vice president for operations, Milton Arnold, said the radar traffic control permits airline IFR operations at virtually the same capacity as VFR and has shifted the airline operating bottleneck from the air to the ground, where lack of ramp handling and parking facilities are the limiting factors on scheduled airline operations at Washington National.

Washington National operational statistics compiled by chief controller Thomas A. Basnight, Jr., during the three-month bad weather period of the winters of 1952 and 1953 show the following difference before and after radar traffic control had become operational:

- 1952 without radar control—2,239 IFR landings and takeoffs. Total traffic delay: 76 hr. 58 min.
- 1953 with radar control—5,570 IFR operations. Total traffic delay: 9 hr. 9 min.

The Washington radar system uses the following equipment:

- **MEW with Skiatron.** The long-range Microwave Early-Warning Radar is war surplus equipment given to CAA by USAF. It has a civil range of 100 mi. and is located in the Airways Traffic Control Center (ATC), where its information is displayed on two Skiatrons —a Navy wartime device that magnifies the data of an ordinary radar scope and also supplies heading and ground speed information. Both the MEW and Skiatron are built by General Electric Co.

This equipment is used by ATC to

control traffic before and after it enters the airport approach control zone, locate lost aircraft, provide thunderstorm warning service in the Washington area and give radar separation to traffic approaching and leaving the Washington area.

• **Airport Surveillance Radar (ASR-1).** Antenna for this unit is located on a hilltop in Arlington. The scope is in the airport control tower, with a canvas hood enclosing scope and operator for daylight operations. ASR-1 is built by Gilfillan Brothers of Los Angeles and has a range of 30 mi. The radar traffic controllers working the ASR-1 scope pick up traffic routed by ATC to the four major approach fixes in the Washington area and direct it to a heading that brings aircraft onto the instrument landing (ILS) localizer course, a minimum of three miles from the range station.

• **Precision Approach Radar (PAR-1),** otherwise know as GCA. The GCA scopes are located in the airport control tower under the same hood as ASR. Two scopes, each giving both azimuth and elevation information, are incorporated in a single unit. One scope has a 10-mi. range and the other a three-mile range. A separate controller operates the PAR, gives the aircraft pilot a GCA approach if requested, or monitors his ILS approach and gives warning information if serious deviations from the ILS path are noted. PAR-1 also is made by Gilfillan.

• **Automatic VHF/DF.** The Bendix-manufactured direction finding equipment is installed as part of both the Skiatron and ASR equipment and enables radar traffic controllers to get a bearing on an aircraft within radar range when it transmits on VHF.

• **VHF air-to-ground radio communications.** The radar traffic control system is dependent on direct radio communications between aircraft in the traffic pattern and the airways and approach controllers. Formerly communications were relayed via airline or CAA radio stations. The elimination of the three-to-10-min. communication relay delay has been a major factor in speeding up the traffic flow.

Briefly here is how the Washington system works.

Traffic on the airways converging on Washington is picked up by ATC on the MEW about 50 mi. out and fed into the four main approach gates to Washington terminals. These approach gates are electronic "fixes" of some kind, usually a fan marker or a compass locator station. They are from seven to 20 mi. from the airport.

As soon as incoming traffic is picked up and identified on the Skiatron, normal airways separation of 15 mi. is reduced to five because of the positive position indication on the radar scope. Along the airways, ATC has to rely on the pilot's report of where he thinks his aircraft is; but on the radar scope, ATC knows where the plane is. ATC also brings inbound traffic down from assigned cruising altitudes to 2,000 ft. over the approach fixes.

▶ **Control Shift**—At these fixes, approach control working the control tower ASR picks up traffic. Usually two controllers work the tower scope, each working two approach gates with a third

French Announce Mach 1.5 Interceptor

By Ross Hazeltine
(McGraw-Hill World News)

Paris—A French supersonic interceptor of novel design made its first test flight from the Melun-Villaroche airfield near Paris Mar. 2.

The S. O. 9000 Trident, built by the nationalized company SNCASO, is the first French plane designed to exceed the speed of sound in horizontal flight. Marcel Dassault Mystere II's have crashed the sonic barrier in dives.

The Trident officially is super-secret. The announcement of its first flight merely said that the plane had performed satisfactorily and that tests would continue for several months before supersonic speeds would be attempted.

▶ **Straight Wings**—Well-informed aviation circles, however, describe the Trident as a response to the French air ministry's search for a speedy interceptor with a very fast rate of climb and a relatively slow landing speed so that less elaborate and costly base facilities would be required.

The Trident is a very small lightplane with unusually short, straight wings. It is powered by two Turbomeca Marbore II jet engines of 880 lb. thrust placed in nacelles at each wingtip. In addition, it carries a rocket in the tail with fuel for only a few minutes' operation.

The rocket was built by the Societe d'Etudes de Propulsion par Reaction and is reported to develop about 9,000 lb. thrust. With the rocket in operation, the plane is expected to reach speeds of about Mach 1.5. When the rocket fuel has been exhausted, reducing weight considerably, the plane can land at a speed substantially lower than any other modern fighter.

▶ **Second Prototype**—The Trident is the result of studies begun by SNCASO in 1948. Construction of the first prototype began in October 1951, and a second prototype now is being built.

The rocket propulsion was developed after extensive flight tests of similar but less-powerful rockets on the four prototypes of the S.O. 6021 Espadon. Details of the construction of the new interceptor are secret, but it is reported that the Trident is relatively simple and inexpensive and can be built rapidly in large quantities.

man posting traffic information between them. A second ASR scope is being installed at Washington National tower, so each controller eventually will have his own scope. Traffic separation is reduced to three miles and the aircraft vectored onto their final runway approach heading along the ILS localizer.

"Stacking" and "holding" have been virtually eliminated. By reducing the separation intervals between aircraft and vectoring them into the final runway heading by various paths and at various distances from the field, traffic can be kept at a steady flow onto the landing runway. Usually no more than an extra 360-deg. turn around the approach fix or a slightly longer path onto the final approach heading is required to maintain the three-mile separation between planes in the approach area.

▶ **Departure Control**—Departing traffic is cleared by ASR and picked up by ATC three miles from the end of the takeoff runway. ATC then vectors the departing traffic to its assigned course and cruising altitude. Generally, approaching traffic is kept high and departing traffic low so that a simultaneous flow can be maintained in both directions.

Pilots are given reports on traffic in their immediate vicinity and vectors to avoid it if necessary.

Initial experience with the Washington system indicates two definite requirements for improvement:

• **Altitude information on the radar scopes.** At present, no altitude information is automatically furnished by the radar and must be obtained from the aircraft. This is not satisfactory and causes an unnecessary load on the VHF communications system.

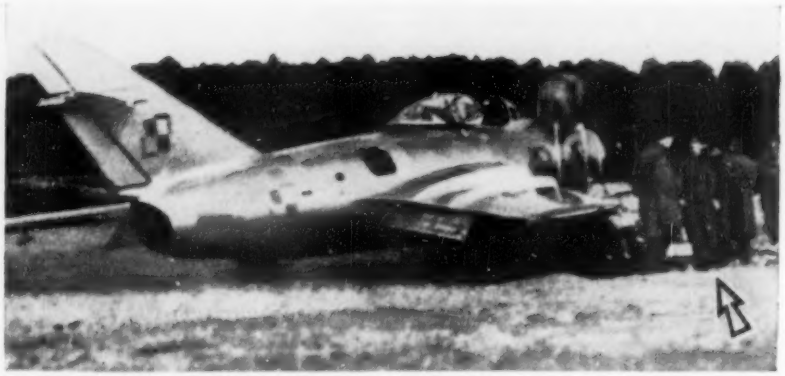
• **Airborne radar beacons.** Aircraft have no way to identify themselves positively on the radar scope to the traffic controllers. Joint airline-government committees have been working on this problem for several years; but no solution has been reached, although military aircraft have been using such identification equipment since early in World War II. Aircraft are now identified by executing a turn prescribed by the traffic controller, taking special heading as directed or by a VHF/DF bearing. This is far from ideal.

Airline Insurance Studied

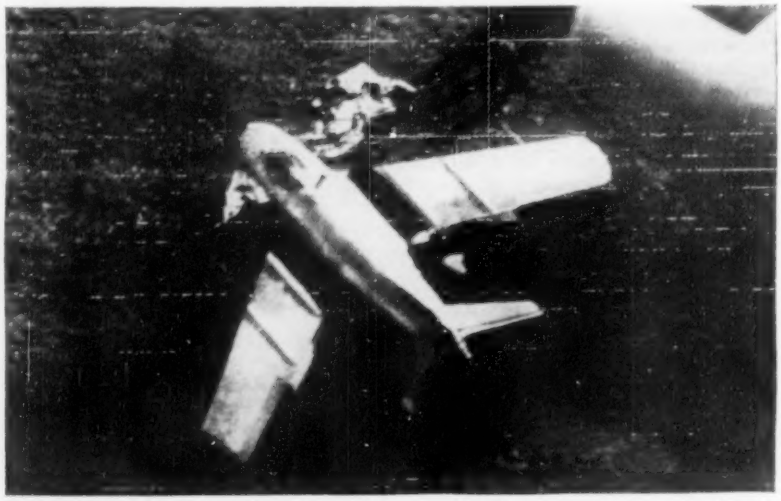
(McGraw-Hill World News)

Rome—Scheduled airlines operating in Italy would be forced by a bill introduced in the House of Deputies to carry $9,000 accident insurance policies on each passenger.

The proposed air insurance legislation also would hold carriers liable for loss or damage of baggage, setting the maximum policy payment per passenger at $350.



SIDE VIEW of MiG which was flown into Allied territory in Europe shows glossy finish (apparent from reflections in wing and fuselage nose). Vertical fin appears higher and more rounded than on earlier models.



TOP VIEW of MiG shows high degree of sweep and stubby fuselage that characterize the Red fighter. Note that wing fences extend to trailing edge. Deflected flaps and elevator distort outlines of surfaces.

Allies Get Look at Intact MiG

No radical new equipment found on 3-year-old model flown into Denmark; engine is a copy of early Nene.

Copenhagen—Military observers outside the Iron Curtain are getting their first look at an intact MiG because a young Polish pilot made a break for freedom.

First-hand Report

When news came that a Polish MiG had landed in Danish territory, AVIATION WEEK sent its London correspondent, Nat McKitterick of McGraw-Hill World News, to Copenhagen for a first-hand report. This story is based on his cabled information.

Although the pilot, Francis Garecki, and his prize were closely guarded secrets in Denmark's military base at Vaerlose outside Copenhagen, the secrecy was diplomatic, not military.

Since Garecki landed Mar. 5 at Ronne Airport on Bornholm, Danish island 60 mi. north of the Polish coast, the MiG—apparently an older model built about three years ago—had been taken apart, packed into seven crates, shrouded in sailcloth and shipped to the mainland. It was being put together again at Vaerlose.

▶ **To Be Returned**—There is indication that Poland will get the MiG back in due course. But the Ronne air strip was too short to launch a jet fighter; so is that at Vaerlose. That can only

be done from Kastrup Airport in Copenhagen.

Bornholm observers noted no radical new equipment, nor did the aircraft have radome in the nose as later model MiGs–17S and 19S–are thought to have.

The engine appears to be an early copy of the Rolls-Royce Nene exported from Britain to Russia in 1946. The Russian designate it VK1.

► **Smooth Finish**–The plane's surface was called exceptionally smooth, the skin polished to a glittering finish. Skin appeared to be heavy material; joints were smooth and flush, and riveting was described as up to western standards. Descriptions stressed the excellent workmanship and maintenance practice reflected in its appearance.

Danish observers said the MiG instrument panel looked remarkably like western types, with altimeter, artificial horizon and Mach meter. A two-way radio was thought to be VHF.

The MiG ejection seat was said to be a copy of a German type of World War II and lighter than the standard Martin-Baker seats. No bomb racks were under the wing, nor was there other evidence of external armament. Wings have boundary layer fences.

Observers don't expect official assessment of this MiG soon, if at all; political implications have forced a tight news blackout by the Danish Defense Ministry.

(First reports agreed in general with known MiG characteristics as reflected in an earlier, USAF, evaluation (AVIATION WEEK July 7, 1952, p. 10)–Ed.)

► **Trip From Poland**–Garecki's flight started the morning of Mar. 5, when with five other MiGs he took off from Svulbsk Airport near Colberg in the former German territory of Poland. After about half an hour at 18,000 ft., he jettisoned his three reserve tanks and dived for Bornholm.

He put down on the outer limit of a grass strip less than 4,000 ft. long which passes for the Ronne Airport, coming in with full flaps down at a speed above 200 mph., rolled to within 100 yd. of the end of the strip then ground-looped. The only damage was slight distortion of the right landing gear. There was still fuel in the main tanks.

Garecki was wearing a leather flying suit and helmet, but no parachute.

Col. Erik Rasmussen, investigating the MiG for Danish authorities, estimated its speed in its dive for Bornholm at 650 mph.

► **First Test**–In a sense, Garecki's exploit gave Denmark its first test as a NATO member. At midweek, diplomatic tension was high in Copenhagen, and all NATO embassies had instructed their personnel not to talk of the aircraft to any news man or other outsider.

Poland has demanded the plane's return, but the Danes are accusing the Poles of violating their territory with a fully armed military aircraft, and demanding time to investigate the reason for the flight.

Propellers and Other Products of Plants Manufacturing Aircraft Propellers

Value of shipments, by quarter, January-December 1952

(All figures in thousands of dollars)

	Value of all products	Props and parts total	Military aircraft total	Civilian aircraft total
First quarter	$35,954	$32,723	$28,059	$4,664
Second quarter	38,491	34,757	29,662	5,095
Third quarter	35,375	31,747	27,499	4,248
Fourth quarter	45,528	40,117	34,526	5,591
Totals	$155,348	$139,344	$119,746	$19,598

Prop Shipments Up 39% in 1952

U. S. propeller manufacturers shipped a total of $139.3 million worth of props and parts, an increase of 39% over 1951 shipments of $100.1 million.

Bureau of the Census and Civil Aeronautics Administration issued the figures jointly in a roundup of propeller manufacture for 1952, as compiled from all 10 U. S. prop producers.

Major share of propellers produced went to the military. They received $119.7 million or 86% of the total 1952 shipment. Civilian aircraft manufacturers got the remaining $19.6 million in propellers.

The military received 47% more propellers than in 1951, and shipments to civil manufacturers increased 4%.

Production gained during the first two quarters of the year, declined in the third and rose considerably in the final quarter of 1952.

C-119 Fuselage, Tail Sections Beefed Up

Structural modification of the Fairchild C-119 Packet series to solve operational problems encountered in the Korean combat zone has been completed, according to the Aircraft Division of the Fairchild Engine and Airplane Corp., Hagerstown, Md.

Modifications were aimed at strengthening the fuselage and tail booms and improving flight control characteristics. Initial modifications were incorporated in R4Q models coming off the Hagerstown line for the Marines. All changes will be incorporated in C-119 models, already in service with the Air Force, and in C-119Gs, now being built at Hagerstown.

► **Principal Modifications**–This will be done:

- **Ventural fins** added to tail sections.
- **Changes in spring tabs** of the rudder control systems.
- **Strengthening tail boom assembly.** Bending strength of the tail booms has been increased to withstand loads up to 17G. Fairchild said there have been no cases of tail boom failures, either in Korea or domestically, since the modification was made.
- **Strengthened fuselage.** Main fuselage frames have been "beefed-up" to withstand crash loads of 4.5G vertical, 7G forward and 1.75G laterally. All fuselage frames aft of the wing also have been strengthened to resist forces which might be incurred during nose-up landings.

Fairchild said the modifications were made after C-119 Korean combat experience in rough field landing and take-off conditions.

A completely modified Packet recently was demonstrated by a Fairchild crew–headed by E. R. (Dutch) Gelvin, assistant chief of flight test–for a Marine audience at the Naval Air Test Center, Patuxent River, Md. This Packet successfully performed under the following conditions:

- **Abrupt rudder kicks** with 344 lb. of direct rudder pressure applied in three-tenths of a second at an indicated airspeed of 220 mph.
- **Highspeed side slip** with 300 lb. rudder pressure applied at an indicated airspeed of 261 mph.
- **Rolling pullout** with maximum aileron forces.
- **Fully loaded pullout** of maximum dive with a 3.75G force during recovery operation.

Fairchild officials said the modified Packet is "the strongest medium transport on military service today" and is "the only medium transport with combat maneuverability permitting evasive action to be taken under high speeds and all weather conditions."

Aircraft Orders Backlog

Last Quarter 1952

Value of backlog of orders, net new orders and net sales reported by manufacturers of complete aircraft, aircraft engines and propellers

(all figures in millions)

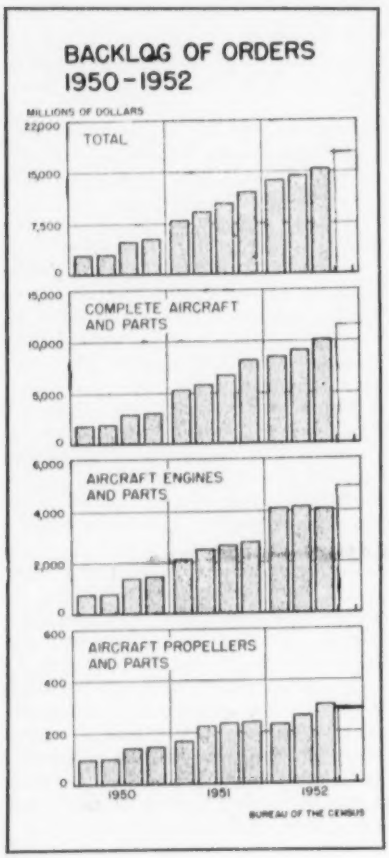
Product	Backlog Sept. 30 1952*	Net new orders during quarter**	Net sales during quarter	Backlog Dec. 31 1952
Complete aircraft and parts	**$10,098**	**$2,327**	**$1,228**	**$11,197**
For U. S. military customers	9,271	2,194	1,104	10,361
Other	827	133	124	836
Aircraft engines and parts	**4,617**	**1,110**	**548**	**5,179**
For U. S. military customers	4,441	1,062	507	4,996
Other	176	48	41	183
Aircraft propellers and parts	**309**	**31**	**42**	**298**
For U. S. military customers	277	25	35	267
Other	32	6	7	31
Other products and services	**976**	**246**	**234**	**988**
Totals	**$16,000**	**$3,714**	**$2,052**	**$17,662**

*Revised

**New orders received during quarter, less terminations during quarter. Data for determinations are not shown separately to avoid disclosing figures of individual companies.

Source: Bureau of Census

Aircraft Backlog: $17.6 Billion



Aircraft order backlogs continued the upward trend of the past two years during the final quarter of 1952, reaching a new postwar high of $17.6 billion. Bureau of Census and Civil Aeronautics Administration reported the increase in their quarterly survey of aircraft engine and propeller manufacturers.

Much of the increase is accounted for by new orders for complete aircraft and parts, which exceeded sales during the quarter by 89%. New orders totaled $3,714 million.

Since Sept. 30, end of the third quarter of 1952, the backlog has climbed 10% from $15,457 million. It was 39% higher Dec. 31 than a year ago.

► **Backlog Bulk**—Biggest share of the backlog—63%—consists of orders for complete aircraft and aircraft parts. Up 11% from the previous quarter, the airplane backlog amounts to $11,197 million. Manufacturers of aircraft engines and parts had 12% higher backlog at the end of the recent quarter than they had at the end of the previous quarter. The year-end engine backlog was $5,179 million.

Unfilled orders for propellers and parts decreased 4% in the final three months of 1952. With 2% of the total backlog, propeller and parts manufacturers had unfilled orders totaling $298 million.

► **Defense Backlog**—Military orders comprised the following percentages of the total backlog: aircraft and parts, 93%; engines and parts, 96%; and propellers, 90%.

Because both the prime contractor and subcontractor report the value of subcontracts, if both are airframe producers, there is some duplication in figures on the value of the backlog, new orders and net sales of complete aircraft and parts. As measured by major subcontracts let by airframe producers to other airframe producers, duplication in the value of backlog or orders amounted to $360 million at the end of 1952.

Value of total backlog, excluding duplication resulting from such subcontracts, was $17,302 million at the end of the fourth quarter and $15,625 million at the end of the third quarter.

BuAer Considering Alternates for J40

Navy's Bureau of Aeronautics last week confirmed earlier AVIATION WEEK stories that it is actively considering alternate engines for several advanced aircraft types now powered by the Westinghouse J40.

Navy also has greatly curtailed the J40 production program scheduled for the Romulus, Mich., plant of the Ford Lincoln-Mercury Division, according to an official BuAer spokesman. Navy and Ford jointly announced a multi-million-dollar increase in the Ford J40 program as recently as Jan. 16. At that time the Ford J40 backlog was listed as $154 million.

Planes affected by the Navy's alternate engine study are:

• **McDonnell F3H carrier-based interceptor.** The Demon prototype is now flying with an early model J40. Alternate engine for production models will be the Allison J71. McDonnell also has switched to a P&WA J57 for its F-101 USAF penetration fighter.

• **Douglas A3D, twin-jet carrier bomber.** The A3D prototype is flying with two J40s, but production models will be powered by a pair of J57s. USAF versions of the A3D design (RB-66 and B-66) will be powered by the J71.

• **Douglas F4D, bat-winged carrier-based interceptor.** The Skyray prototype is flying with a Westinghouse J40-6. Alternate engine proposal is the J57 with afterburner.

The BuAer spokesman told AVIATION WEEK that the phasing in of alternate engines would be governed by the relative progress of the J40 and its rivals. It is likely that Navy will produce aircraft types powered by two different engines, similar to the plan that kept both Allison and P&WA engines in the Grumman Panther program.

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RAF Buildup

- **British budget indicates air rearmament delay.**
- **But first Swift squadron will be formed by June.**

By Nat McKitterick
(McGraw-Hill World News)

London—The British Air Ministry's 1954 budget indicates that for another year the Royal Air Force probably will have to rely more on promise than performance.

By Coronation time in June, the RAF will have its first squadron of sweptwing fighters. About a dozen or so Supermarine Swifts will be in the air by then. But the F-86 Sabre will be the real backbone of RAF Fighter Command.

Deliveries of Canadair-built Sabres will continue through next summer. Some 365 in all, they are being formed now into squadrons for service with RAF 2nd Tactical Air Force under Lt. Gen. Lauris Norstad, Allied Air Forces commander in Central Europe.

Air Minister Lord de L'Isle and Dudley has announced that a further shipment of Sabres, this time from the U.S., will be supplied to RAF Fighter Command. There are "substantially fewer" numbers involved in the second shipment, but all should be delivered to Great Britain this year.

▶ **Rearmament Stretchout**—Significantly lacking from the Air Minister's recent budget speech was any mention of the Hawker Hunter. Last fall Lord de L'Isle and Dudley "hoped" the RAF would have a squadron of Hunters this year. But now indications are that production won't make this possible. A $69-million contract for Hunters for the North Atlantic Treaty Organization to be supplied under the Mutual Security Agency "offshore purchase" program, still is gathering dust in the U.S. Embassy in London. Despite prolonged negotiations, the Ministry of Supply has yet to come up with an offer to supply the Hunters.

The 1954 Air Ministry budget also bears out the recent stretchout in Britain's air rearmament. Spending on aircraft, engines and spares is to go up from $311 million to $393 million this year.

About a third of the increase may represent higher prices; the rest, increased deliveries. Under the original defense program laid down in 1950, the increase this year might have been double what it actually is.

Total spending on the RAF this year is estimated at about $1.5 billion—an increase of $224 million. This includes $140 million in U.S. defense aid. In addition to increased deliveries of aircraft, engines and spares, the new budget allows for stepped-up deliveries of armament, communications and radar equipment.

▶ **Air Strength**—At the same time, the RAF's construction program has passed its peak, and spending this year will be somewhat reduced. Also, the total strength of the RAF—now 279,000—will level off this year, perhaps dropping to about 276,000.

Investment in future research is well up this year in line with Prime Minister Churchill's policy of "quality, not

DOUGLAS B-47 PRODUCTION

This picture progress report of Douglas Aircraft Co. production, under license, of Boeing B-47B Stratojet bombers at Tulsa, Okla., shows six of the craft being completed. Note large access door hanging open under B-47's nose, other access panels open along top of fuselage. First Douglas-built Stratojet made its maiden flight last Dec. 12. The company is also modifying the six-engine jet bombers.

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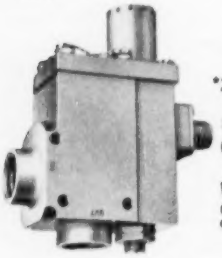

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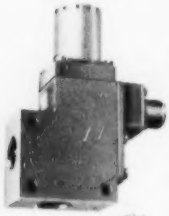

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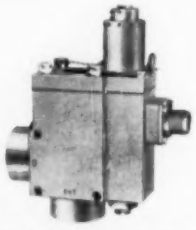

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quantity." The Ministry of Supply, which administers all research programs, says it will spend "well over" $280 million this year in the general area of rocket and missile development. This is an increase of some 40% over two years ago. No figure was given for last year's expenditures.

Outside of the arrival of the Swift, this year's expected deliveries to the RAF are distinctly unexciting. Bomber Command will get its first Canberra photo-reconnaissance squadrons. In Europe, 2nd TAF (Tactical Air Force) will get substantial numbers of Venom F.B. 1 fighter bombers and Venom N.F. 2 night fighters.

► **Civil Transport Boost**—Perhaps the best news in the Air Ministry's budget was for the hard-pressed private civil transport operators. Air Ministry air trooping contracts, which provide life-or-death income to the private operators, are on the increase.

Last year the percentage of troop movements for all three British services that used air transport increased from 25% to 49%. About 85% of all trooping done in the Suez Canal zone is now done by air. The Air Ministry claims the cost of air trooping has turned out to be, in general, not more than the cost of sea transport—without taking into account the time during which personnel are non-effective while traveling at sea.

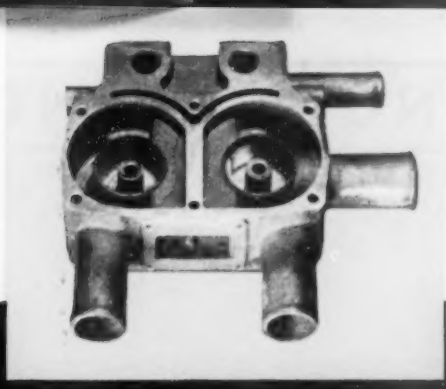
Lightplane Shoulder Harnesses Urged

Voluntary action of U. S. private aircraft manufacturers to provide for shoulder harnesses in all airplanes built after July 1 has been requested by the Cornell Committee for Transportation Safety Research.

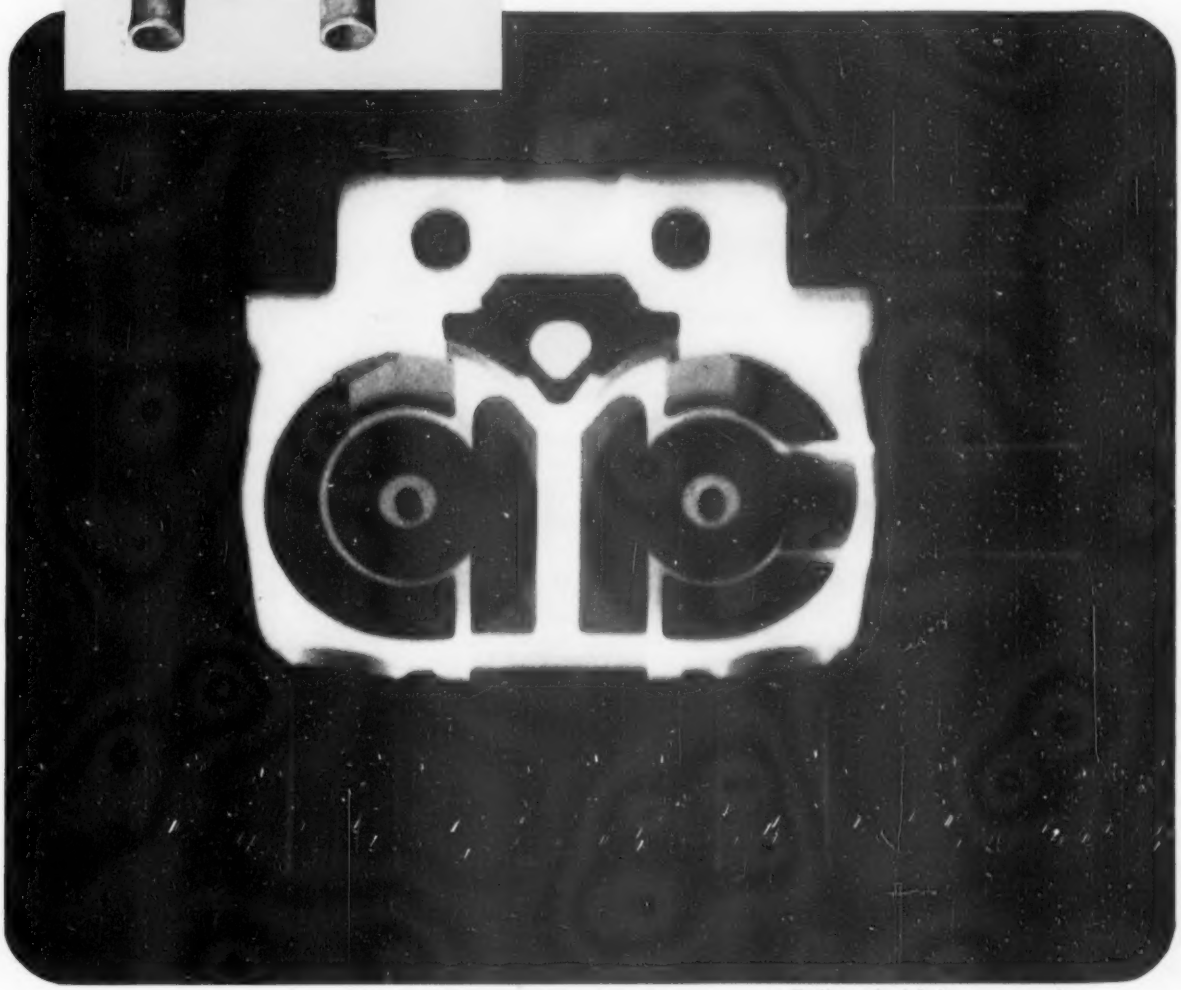
The committee includes specialist engineers from Cornell University, Ithaca, N. Y., the Cornell Medical College Crash Injury Research and Cornell-Guggenheim Aviation Safety Center, New York City, and Cornell Aeronautical Laboratory, Buffalo.

The Cornell resolution also called for structural design to prevent collapse of aircraft cabin structures during a crash at minimum flying speed.

Specifically, the proposal asked that shoulder harness attachments be provided at each seat in all new non-transport aircraft designed and built after July 1. Fittings and carry-through structures should be built to take loads of at least 1,000-1,500 pounds, and not fail when the loads move forward within a 30 deg. angle with the longitudinal axis of the airplane, the committee said. The resolution also asked the manufacturers to encourage use of shoulder or chest harness by pilots and passengers.



This heart must pulse or the Plane's in trouble—



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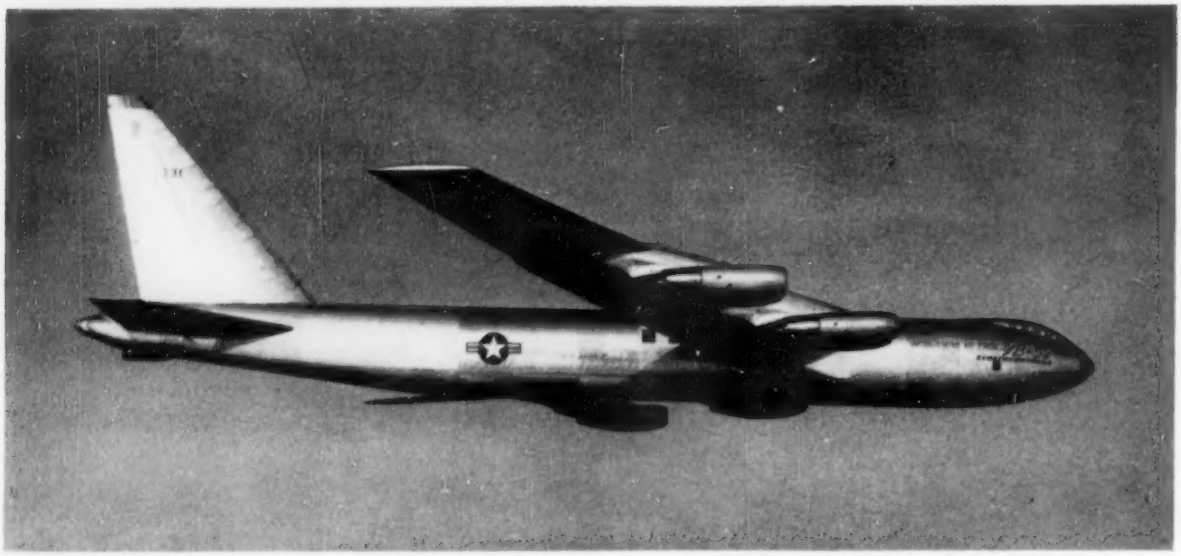


MILITARY aircraft demand jet turbines adaptable to a variety of missions and capable of highest possible performance, while . . .

Plan for Broadening Jet Engine Design

Engineer proposes multi-purpose turbine powerplants, adaptable to military planes and civil jet liners.

The aircraft gas turbine was born in the midst of a military emergency. Ever since, it has been designed almost exclusively for an ever-widening progression of military applications.

Though the demand for civil-use aircraft gas turbines is no very big factor now, the civil turboprop- and turbojet-transport era is approaching fast from small, but significant beginnings in Britain. The civil turbine is bound to grow, in the not-too-distant future, into a powerplant with large commercial demand.

▶ **Civil Slant**—Airline operators have their own ideas of what a jet engine should offer. Like the military, they have a critical eye for the equipment they fly. But the gaze usually is in a different direction. It isn't likely that civil operators will take jets that have been designed for military applications and draft them "as is" for civil-transport service.

De Havilland was faced with this situation when it brought out the Comet (Aviation Week Aug. 25, 1952, p. 21). In the transition of DH's Ghost engine from its military status to civil use in the Comet, the changeover was extensive, necessitating re-doing of more than 60% of the original detail drawings. Reliability and safety were the dominant factors in this service transition from military to civil application.

DH's engineering director put it this way: "The fact cannot be overstressed that civil engine development, especially for airline operation, needs its own mentality and experience for successful fruition and there are no short cuts."

▶ **Triple Use**—Undoubtedly jet power plant engineers here are doing a little advance thinking, anticipating the potential of the civil jet market.

One intriguing line of thought is to design jet powerplants so they will fit more than one role. By extension of proper design concepts, new jet engines possibly can be made for a triple-service status—military, non-combat military and civil.

Some compromises may be necessary, but these might be minimized by variation in operating techniques. This scheme is no short cut, but rather a planned approach.

The factors behind this type of approach recently were outlined before the annual meeting of the Society of Automotive Engineers by Robert T. Holland, product planning engineer on transport in General Electric's Aircraft Gas Turbine Division, Evandale, Ohio.

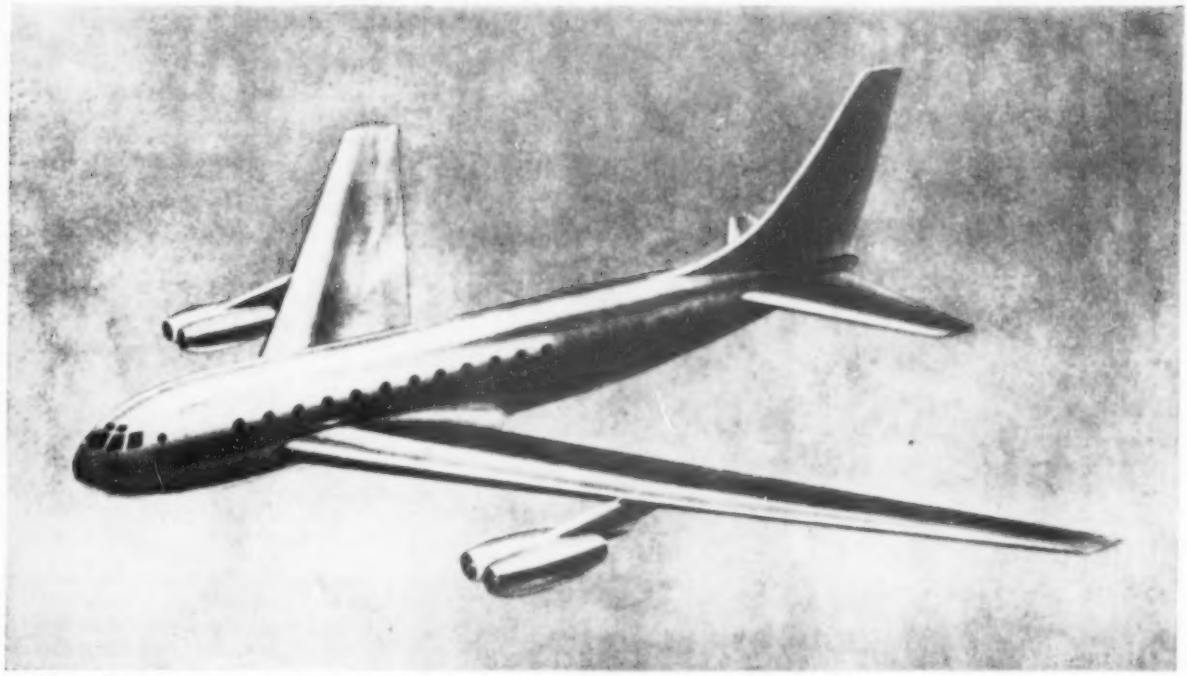
▶ **Basic Characteristics**—The difference between civil and military aircraft gas turbine designs resolves itself to a matter of judiciously assigning relative values of importance to fundamental design characteristics—performance, output, reliability, durability and cost.

- **Performance** is defined as the engine's specific fuel consumption at altitude, plus engine weight.
- **Output** is the engine's thrust.
- **Reliability** is characterized by freedom from sudden malfunction or failure.
- **Durability** is measured by the ability of the engine to resist wear and give long life, where such wear and general deterioration is gradual and predicatable. It is possible for a design to have high-reliability and low durability and vice versa.
- **Cost** refers to operating costs.

▶ **Similarities**—Holland contends that it would be difficult to support a contention that there should be any difference between military and civil requirements for the characteristics of performance, output and reliability, except as the adaptability of the design is affected by specific missions to be performed.

The variety of military missions appears to call for a greater degree of adaptability of design, whereas the range of requirements or route applications of the transport operator apparently are much narrower.

In general, the levels of performance and output that are suitable for the military will be suitable for the civil operator. Holland points out that the economics of engine development actually appear to preclude the possibility



CIVIL jet liners of tomorrow will need jet engines that provide greater durability and lower operating costs.

of the civil operator being able to get any higher design levels than the basic military design provides.

Reliability in either type of operation, in terms of safety and ability to continue to operate, is of the same desirable high order in each case.

But when the resources that are available to the military and the civil operator are considered, it is possible that the latter requires a greater degree of reliability of equipment to be put into service with planned regularity.

This comes about because of the civil operator's desire for maximum utilization—in turn brought about by the necessity for low inventories and desire for low capital investment. Holland points out that the military field commander has just as great pressure upon him to have the maximum number of his aircraft in combat readiness, but military practice in the past has been to overcome this problem by sheer quantities of equipment.

With respect to the reliability characteristic, any good military engine, in general, will be a good civil transport engine.

▶ **Differences**—The outstanding differences, Holland contends, appear to be in the durability and cost characteristics.

Here, he says, any engine that meets the civil transport requirements will also be a highly desirable engine for the military. Two types of military operations should be considered—combat and non-combat activities.

• **For combat use,** logical assignment of values would seem to demand the highest order of performance and output, with compromises to be made in cost, durability and reliability—in that sequence.

• **Non-combat operations,** such as training and the maintenance of equipment with combat potential, probably should have a different assignment of values. Here, prudence and economics indicate that greater weight should be given to the durability and cost characteristics, Holland says. He sets up this non-combat military operation as a middle ground area involving characteristics between the two extremes of combat-military and civil status, then gives some design considerations that will promote these characteristics.

▶ **Desensitization**—A concept which will maximize durability and reliability with attendant lower operating cost is to "desensitize" the design to quality control.

This doesn't mean that the need for high quality control is minimized. Actually, excellence of quality control is of greatest importance to durability and low cost and it is a must for reliability of operation.

A most rewarding method of desensitizing a design to quality control is through the use of fewer parts that are subject to the procedure, Holland claims.

For example, on a given design, the fewer the number of bearings, the lower the probability of a bearing failure. Because anti-friction bearings require a very high degree of quality control, a higher degree of reliability and durability will be obtained in any engine which has a minimum number of bearings, since the probability of encountering bearing trouble will be lessened, he contends.

Another high-quality-control area in the engine is compressor blading. Here, the problem could be solved by the process of avoidance—using a centrifugal-type compressor instead of the axial-flow configuration.

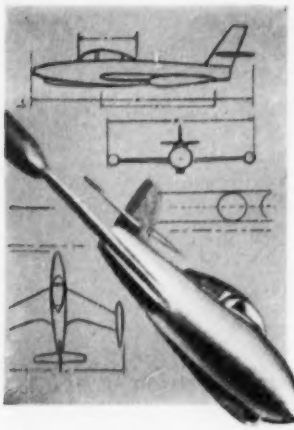
But since the performance penalties would be unreasonable, the axial-flow unit itself must be examined to see if it can be desensitized to quality control, Holland maintains. Here again, automatic increases in durability and reliability would be obtained with the use of a minimum number of blades compatible with performance and output requirements. Fewer blades reduce the statistical chances of failure.

There are many other areas in the gas turbine where this concept can be used to achieve higher durability and reliability. The designer who is evaluating alternate designs would do well to examine the high quality-control items on a numerical basis, Holland claims.

▶ **Process Selection**—Reliability characteristics are affected by production methods. Those processes should be favored which introduce a minimum number of operations.

It is preferable to forge a part to final shape in one operation rather than use successive steps where the probability of introducing folds and defects would be increased.

It is also desirable to minimize machining operations, although, in gen-



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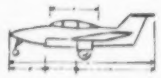

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eral, cutting operations are less likely than others to introduce flaws that are difficult to detect upon inspection.

Where quality-control requirements are very high, consideration should be given to the concept of avoiding the problem. As an example, Holland mentions the two-piece turbine wheel construction, where successive welds are required to join the parts. This procedure increases the susceptibility of these welds to errors of quality control.

Other things being equal, a higher degree of reliability, and perhaps some increase in durability, probably could be achieved if other design considerations permitted the use of single-piece wheel makeup.

► **Foreign-Object Damage**—Damage to axial-flow compressor blading by foreign objects is the most prevalent cause for premature removal. For a design to have a high degree of reliability, durability and low operating cost, special attention should be given to the reduction of foreign-object damage, Holland says.

Here again, the design could be desensitized by using a centrifugal compressor, but the unacceptable performance penalty again would be introduced. This forces examination of the design alternatives in the axial-flow compressor to reduce susceptibility to damage.

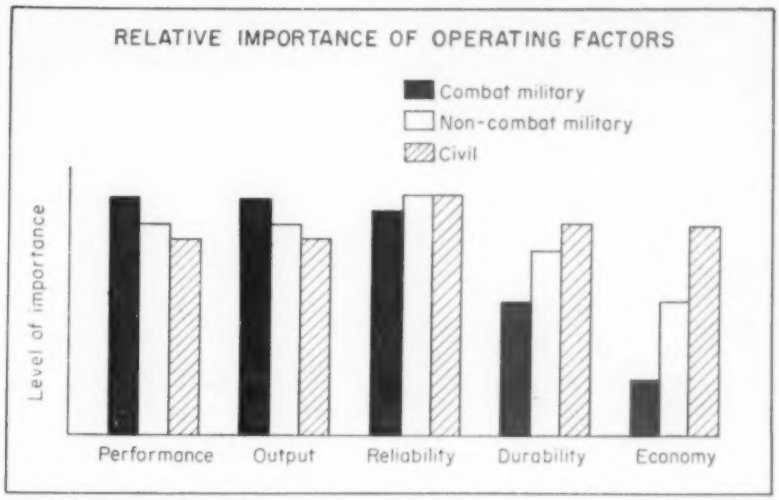
Shrouded stator construction supporting the stator blade at both ends probably would be more capable of handling a foreign object without serious failure. Also, the support at both ends probably would assist in retaining the blade in position even if a fatigue crack should form in the blade.

Spacing between stators and rotors may have a direct relationship to the size of a foreign object that could be accepted by the engine without damage, since the most serious type of damage results from lodging of foreign objects in the stator-rotor clearance space.

Although minor foreign-object damage normally does not affect reliability characteristics directly, it does introduce stress-concentration points that lead to more serious consequences. The tendency, Holland says, would be to use ferritic instead of aluminum material.

Because of the unpredictability of conditions which exist at the moment of impact, serious foreign-object damage is difficult to analyze, and Holland claims it is therefore difficult, and perhaps impossible, to establish the superiority of alternate designs. The most effective solution, he thinks, is to design, operate and maintain the engine "so that nothing except air is exposed to the inlet of the engine."

Design advances have removed accessories from the inlet nose section. This reduces the chances for bolts, nuts and other small hardware to enter the compressor. It also reduces the need



JET ENGINES designed for non-combat military operation would compromise requirements set up by combat military planes and civil air transport needs.

for mechanics to work in this area, so cutting the chances of tools and other materials being drawn into the inlet.

▶ **Screen Factors**—Holland sees the use of a more effective screen as the most rewarding of all approaches to the foreign-object damage problem. Screens are located in the highest velocity region of the inlet duct. In this highspeed area, large performance penalties are introduced as a result of pressure drop—dictating the use of a larger mesh screen than desirable. A finer mesh screen seems to be a necessity for damage reduction.

A practical solution without excessive performance penalties is to locate the small-mesh screen in a low-velocity region of the duct. To get low loss with a fine mesh the screen must be located so that a maximum mesh area is available.

▶ **Fatigue**—Another area for improvement in durability and lowered operating costs is in the reduction of blade failure from fatigue. Although the simpler characteristics of blade vibration are well known, a much more comprehensive analytical approach is necessary to cope with the interacting aerodynamic effects of one blade upon another. These non-steady vibration characteristics are very difficult to analyze. Here, the practical solution demands experience with blading of known characteristics, Holland claims.

As an example he points to steam turbine practice, where successive application of empirical design factors has led to factors in blade design which produce extremely long life and outstanding reliability.

Applying such empirical factors to aircraft gas turbine blade design should produce similar gains in durability with freedom from fatigue failure, Holland claims.

▶ **Hot Parts**—Deterioration and failure of hot parts are the next most prevalent causes for premature engine removals. Holland considers design and operation factors to see how durability, reliability and lower operating cost can be obtained here.

Several factors influence the life-expectancy of these parts. Basic design establishes four of them:

- **Maximum turbine inlet temperature.**
- **Maximum stress level.**
- **Temperature gradients across parts.**
- **Cooling provisions.**

Operational procedure introduces four other factors which greatly influence the life of hot parts—factors which would be changed in shifting from the middle-ground non-combat military plane to the combat-military jet at one end and the civil jet at the other:

- **Percent of operating time at maximum turbine inlet temperature.**
- **Turbine inlet temperature during cruise.**
- **Stress levels during cruise.**
- **Rate of change of temperature.**

Military service experience shows that these operational factors are the most influential in determining hot-gas-part durability, Holland says. Because of the great increase in stress-rupture life that accompanies very small reductions in turbine inlet temperature, the characteristics of durability and reliability can be increased with cruise thrust ratings that are well below the usual military practice, he maintains.

There appears to be no necessity for differences at takeoff between the temperatures for civil operation and military use. It is more important, Holland insists, to strictly limit the duration of use at maximum temperature.

▶ **Recorders, Cooling**—The gains possible through strict adherence to operating limits of temperature and re-

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Transmitters	AY201-1	26V, 400~, 1 ph.	225	1.25	25+j115	11.8	9.5	3.5	15
	AY201-4	26V, 400~, 1 ph.	100	0.45	45+j225	11.8	16.0	6.7	20
Receivers	AY201-2	26V, 400~, 1 ph.	100	0.45	45+j225	11.8	16.0	6.7	45
Control Transformers	AY201-3	From Trans. Autosyn	Dependent Upon Circuit Design				42.0	10.8	15
	AY201-5	From Trans. Autosyn	Dependent Upon Circuit Design				250.0	63.0	15
Resolvers	AY221-3	26V, 400~, 1 ph.	60	0.35	108+j425	11.8	53.0	12.5	20
	AY241-5	1V, 30~, 1 ph.	3.7	—	240+j130	0.34	239.0	180.0	40
Differentials	AY231-3	From Trans. Autosyn	Dependent Upon Circuit Design				14.0	10.8	20

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Receivers	AY503-2	26V, 400~, 1 ph.	235	2.2	45+j100	11.8	23.0	10.5	90
Control Transformers	AY503-3	From Trans. Autosyn	Dependent Upon Circuit Design				170.0	45.0	24
	AY503-5	From Trans. Autosyn	Dependent Upon Circuit Design				550.0	188.0	30
Resolvers	AY523-3	26V, 400~, 1 ph.	45	0.5	290+j490	11.8	210.0	42.0	30
	AY543-5	26V, 400~, 1 ph.	9	0.1	900+j2200	11.8	560.0	165.0	30
Differentials	AY533-3	From Trans. Autosyn	Dependent Upon Circuit Design				45.0	93.0	30

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sponse rate are so great, he contends, as to warrant the serious consideration of recorders to document the frequency and duration of excessive-temperature operation. This would permit more effective preventive maintenance by inspection and replacement of parts prior to costly and unexpected failure.

Also, there is reason to believe that non-combat military and civil operators would be more mindful of the established limits.

In the field of effective cooling and reduction of temperature gradients, Holland says that the military designs already are utilizing everything that is valid. Much more still remains to be learned about combustion and flame propagation. As more data is accumulated it may be possible to distinguish between civil and military designs in the combustion regime.

Until then, the uncertainty of achieving better durability than the military design achieves in this area is prohibited by the performance losses which would be met.

► **Fuel Controls**—The subject of fuel system controls always seems to precipitate long discussions with respect to reliability. Holland does not go into detail here, but points out an interesting design concept. In a balanced control system design, he says, the quality-control requirement of the component should be inversely proportional to the desired reliability. Also, the component should be limited to functions within its own assigned area.

The objective of this concept would be achieved, for example, with a control system that eliminates high-quality-control components from participating in the controlling functions during takeoff, where the highest degree of reliability is necessary.

A slightly higher degree of refinement and indirect control probably is permissible for the cruising regime. Very high-quality-control components that may be subjected to unpredictable failure would be best applied if reserved for controlling functions for operating economy and convenience.

► **Safety**—With respect to safety, Holland says that ignition sources should be separated from combustibles; that there should be provisions for compartmentation and adequate drainage and ventilation under conditions of malfunctioning as well as normal functioning.

Also, each part of the design should be examined to see if the origin of a possible problem can be eliminated. A simple numerical analysis of the number of connections will indicate possible areas of improvement.

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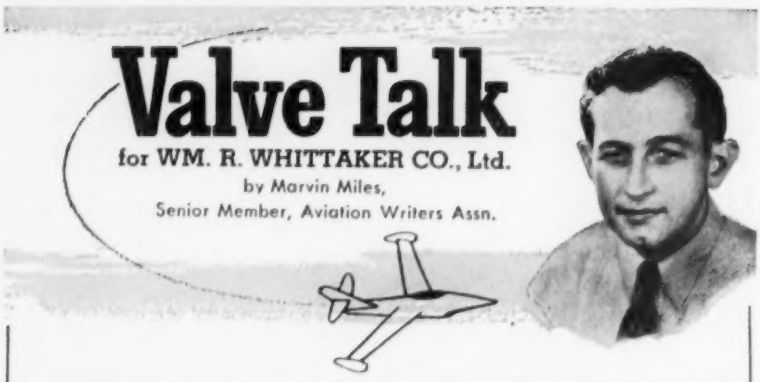
for WM. R. WHITTAKER CO., Ltd.

by Marvin Miles,
Senior Member, Aviation Writers Assn.



I don't know exactly what I expected. A formal and starchy meeting, perhaps. But what I actually found was a shirt-sleeved air of informality in Vice-President Glenn Whitaker's office as the two visitors talked valves with Glenn and his staff.

One was a staff engineer, the other a test engineer, both with a major airframe manufacturer. They were on a special tour to study their supplier firms and talk out problems.

Questions and answers bounced from topic to topic. Laughter and reminiscence mixed occasionally with technical explanations. Naturally, most of the talk was about valves and was pretty technical. I finally got into the act with this question:

"Can you tell me something about your survey, how it came about and what you've learned?"

"Well," replied the test engineer, "it's a trial idea with us. Our people felt the plant should know its vendors on a more personal basis and at the same time have them know us better, too.

"We've visited a dozen plants so far and learned a hell of a lot, some good, some bad. Now we're convinced there's no better way to iron out problems and to gauge the capabilities and capacities of a supplier.

"For instance, we've been fussing with one company for eight months by letter and telephone, but we straightened out the whole situation in a half hour yesterday. You just can't sit back home at a desk and appreciate the other guy's problems or expect him to appreciate yours."

I was surprised to learn that personal contact is the exception rather than the rule in relationship between the major companies and their suppliers—except perhaps for procurement men and design engineers with specific needs and problems.

Apparently most of the big concerns know their vendors only by letterhead, purchased product and through field engineers. But that is only part of the story.

The visiting test engineer gave me a cue on why some firms wouldn't care for expert inspection of methods, men and assembly lines.

"Some plants are dirty, crowded and cluttered, with squirting oil and flying chips. You get the idea that the product must be like the plant. And usually you're not far wrong.

"On the other hand, a clean, efficient plant leaves you confident instead of skeptical, especially when the head men know their business and are glad to compare notes with you over a cigarette and a cup of coffee.

"It's a pleasure, when you've been mentally picturing some supplier as just a garage shop, to walk in and find a smooth-running, up-to-date operation in a modern plant. It sure changes your perspective."

The conversation in Glenn's office left me with the impression that the visiting execs had gained much from their inspections of plants and procedures—and even more from knowing the men with whom their company dealt.

As in any other field, personal friendship cannot be topped for understanding and cooperation. There's a completeness in informal across-the-desk discussion that can't be achieved any other way. And it carries its weight into letters and telephone conversations of the future.

The two visitors saw it about the same way. They told me they figured the benefits of their tour as "about fifty-fifty."

"We've learned a lot to take back with us and we feel our suppliers have learned something about us, too, after years of cut and dried communications. We've talked many things out, squared away a lot of misconceptions on both sides, and gained some mutual understanding."

Whittaker shares this evaluation.

Proud of its people, its plant and its production, the company invites you to drop in, have a look, talk things over.

the accessory maker, the engine builder and the airplane manufacturer to insure that every fitting has an indispensible function.

It is frequently found that extraneous fittings are frozen into design for reasons other than functional use—through segregation of responsibility, differences in engineering opinion, expediency during early stages of design.

Holland claims that it can safely be assumed that designs that achieve a satisfactory level of durability, reliability and operating cost for the non-combat operation will admirably suit the civil-type operation. The concepts he offers are only some of those which will promote designs commensurate with civil requirements. Ingenuity and experience can bring many more.

With these concepts built into the original design, there is every reason to believe, he says, that it will be suitable for all three types of operation—combat military, non-combat military and civil—with the unique characteristics of each being achieved by varying the operational techniques to match the requirements. —IS

THRUST & DRAG

"I read your report on the Loening speech (AVIATION WEEK Jan. 19, p. 35)," said the engineer, "And I tell you, that's the complete story. It's gotten so in this – – – – – – – industry that you can't even – – – – without getting permission from Wright Field."

"Tell me more," I said, signaling the waiter for another round.

"Take our own design," he said. "We whip out a landing gear layout and some lieutenant from AMC takes a look at it and says, 'Change this and use this nut and put safety wire on it.' So we do it. Three days later in comes a captain from AMC, shouts, screams about the idiotic use of that nut and the safety wire and says we should change it back to where it was. Four days later in comes a general, and he looks at the landing gear and says that it doesn't quite look okay to him. He doesn't tell us what appears to be wrong, but his superb intuition tells him something is."

He drained the glass and the waiter brought another round.

"Here's the way it is now," he said. "If these – – – – – – characters from Wright Field would leave me the – – – – alone, I'd get the design done and it would work. And in exchange for their leaving me alone, I'd sign a statement that Wright Field had not only conceived, designed, drawn, built and flown the landing gear, but that they had also conceived the basic idea

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of bird flight which started the whole — — — — — — business. If they want credit for the landing gear, I'll give it to them, but just make them leave me alone!"

Having been a design engineer for a while, I agreed with him. Do you suppose we can do anything about it?

—DAA

NACA Reports

► **Power-Off Flare-Up Tests of a Model Helicopter Rotor in Vertical Autorotation (TN 2870)**—By S. E. Slaymaker and Robin B. Gray, Princeton University.

Softening an autorotative landing of a helicopter is generally done by what is here called the flare-up (although we have generally referred to it as the flare-out).

Flare performance may be improved two ways:

- By increasing the energy stored in the rotor by using heavier blades or higher tip speed.
- By increasing the rate and the amount of blade pitch change in the flare.

This work is an attempt to investigate the practical limitations of rate and amount of blade pitch change required to produce an effective flare-up. Tests have been carried out on a model rotor system for practical values in ranges which would be disastrous in flight. For simplicity, tests were limited to vertical flight.

This investigation was done at Princeton University under the sponsorship of the National Advisory Committee for Aeronautics.

The test model was a two-bladed, controllable-pitch rotor system with an 8-ft. rotor diameter. The blade section was an NACA 0015 airfoil. The model was tested in a 65-ft. high tower by being permitted to drop from the top of the tower onto shock absorbers at the bottom of the tower. A guide wire down the center of the tower passed through the rotor axis to keep the fall of the model vertical.

These are the conclusions drawn by the authors from the test:

- **A more-effective flare maneuver** comes from an increase in rate of change of blade pitch angle and in the amount of the final blade pitch angle for a given disk loading and rotor inertia. But it is indicated that major increases in performance are rather quickly realized, and further increases will yield a diminishing increase in results.
- **The effectiveness of the flare** is increased by an increase in rotor inertia at a given disk loading, rate of change of blade pitch angle, and final blade pitch angle. The effectiveness is de-

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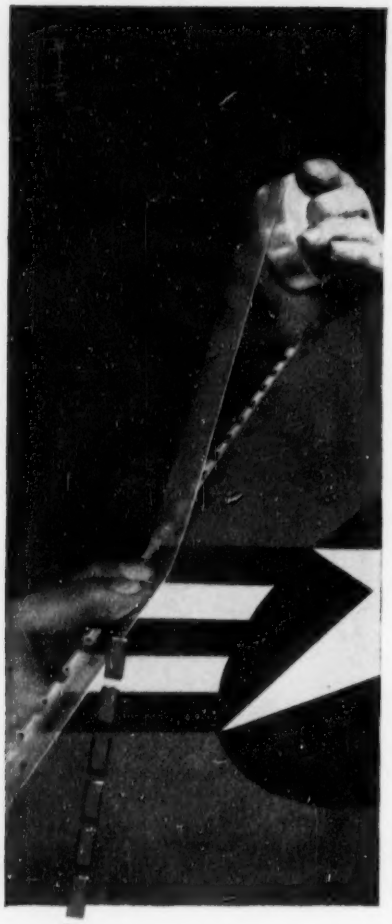

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creased for an increase in disk loading for a given rotor inertia, rate of change of blade pitch angle, and final blade pitch angle.

In this latter case, experimental data seem to indicate that the rotor is capable of reducing the rate of descent by a fixed amount which is dependent only on blade angle, rate of change of blade angle, and rotor inertia. Since the autorotative rate of descent increases with disk loading for a given configuration, the effectiveness of the flare should decrease by about the same amount.

- **The variation of rotor speed** during the flare is primarily linear.
- **The semi-empirical method developed here** yields accurate minimum rates of descent throughout the range of experimental investigation.

Hawker-Siddeley Buys Rocket-Missile Plant

(McGraw-Hill World News)

London—The Hawker-Siddeley group announced last week it had purchased a factory at Salisbury near Adelaide, South Australia, for the purpose of building guided missiles and rockets. The factory will be near the huge Woomera rocket range.

The factory will be used to produce and test guided missiles and rockets being researched by Armstrong-Whitworth, Ltd., a Hawker group member at Coventry. This research is not part of controlled rocket motors being developed by another Hawker member, Armstrong-Siddeley Motors, Ltd., also at Coventry.

The Australian purchase is strictly a private venture on the part of the Hawker group, though it is assumed that the work done there will be on government account. It is fairly common British practice for the government to let research contracts to private firms, who then make their own testing and production arrangements. Sir Frank Spriggs, managing director of the Hawker group, says a very considerable amount of company money is tied up in the venture, but he will not quote an exact figure.

A team of technicians from Armstrong-Whitworth embarked for Australia last week. They will find launching ramps, electronic gear and much testing equipment already installed at the factory.

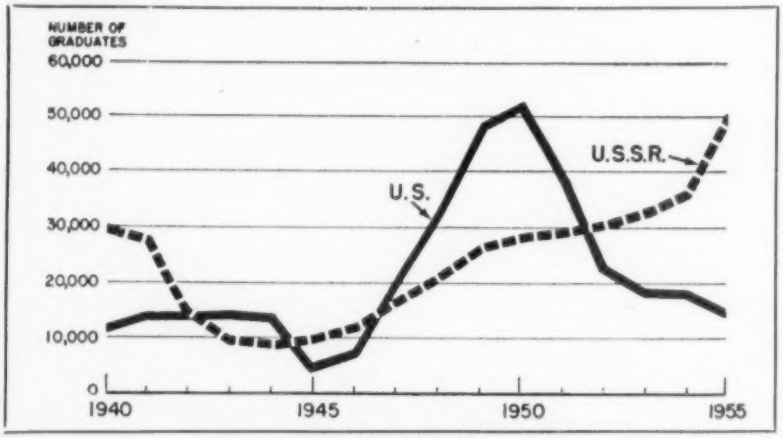
H. M. Woodhams, leader of the team said, "We plan to carry out exhaustive shooting tests into the strato-and ionospheres and beyond. Our research now indicates we are on the threshold of great new developments."

Production of guided missiles has "superpriority" rating from the government here.

Last year Minister of Supply Duncan Sandys said that Britain had developed guided rockets with speeds "well over" 2,000 mph.

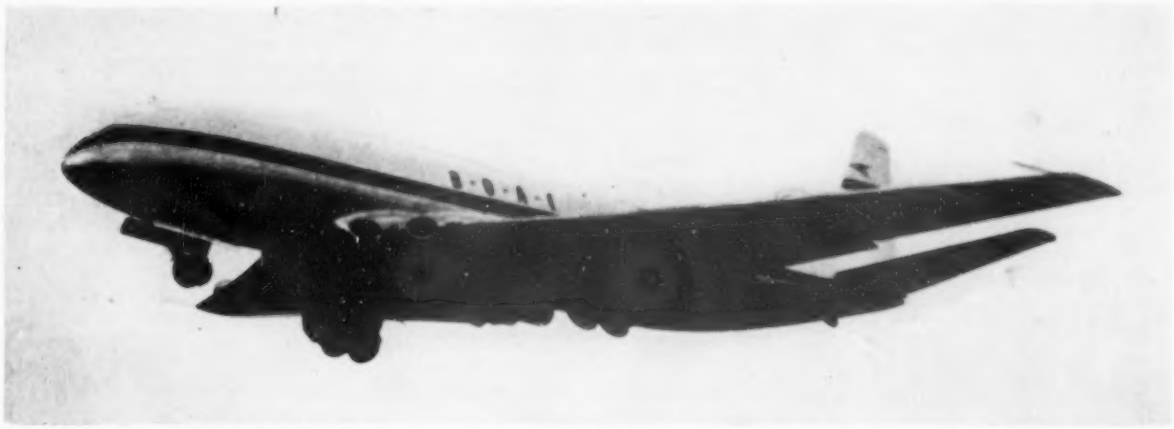
Seat Study Asked

Air Transport Assn. has asked National Advisory Committee for Aeronautics to start a program for dynamic testing of aircraft seats with loads applied in all directions, and to study the controversial issue of backward vs. forward facing passenger seating. Need for the study program is based on the fact that planes do not always crash in a straight fore-and-aft attitude, so that stressing for loads applied from all directions appears necessary.



U. S. ENGINEER SUPPLY DROPS

While the needs of American industry for engineers and trained technicians continue to grow, the supply of new engineers continues to fall. By 1955, Soviet Russia will be graduating about four times as many engineers as the U. S., according to this chart prepared for the National Science Foundation. But, the Engineering Manpower Commission says, industry is now making better use of the engineers it has.



HIGHSPEED JET TRANSPORTS will need more automatic equipment, but its complexity must not rule out reliability.

Are Automatic Controls Too Complex?

- **Avonics equipment would help jet liners maintain their critical engine speeds and pitch attitudes.**
- **But means must be found to get this aid without losing reliability and simplicity, IAS is told.**

By Philip Klass

Future jet liners will need more automatic equipment than their piston-powered predecessors to hold engine rpm. and airplane pitch attitude within critical limits required for economic airline operation, according to E. W. Pike, control and navigation superintendent of British Overseas Airways Corp.

But A. L. Klein, design consultant to Douglas Aircraft Co., warns that automatic devices can be used in highspeed jet transports only if reliability and simplicity are increased. One solution to the problem of reliability would be to design avionics equipment jointly with airframes, rather than adding automatic devices as accessories, Dr. C. S. Draper, of the Massachusetts Institute of Technology, says.

The prediction, warning and recommendation come from a symposium on electronic control and stabilization of aircraft held during the recent Institute of the Aeronautical Sciences convention in New York.

Represented on the 10-man symposium panel were: the Air Force, Navy, an airframe manufacturer, an airline, two avionics manufacturers, three private and government research agencies, and an airline pilot. Edward Warner, council president of the International Civil Aviation Organization, served as panel chairman.

▶ **Critical Limits**—Pike said BOAC experience to date shows that its de Havilland Comets lose:

- **Ten knots airspeed** (11.5 mph.) if airplane pitch attitude changes ½ degree from optimum.
- **Thirteen knots airspeed** (15 mph.) if engine rpm. varies as little as 1% from optimum.

Pike said a 10-knot loss increases fuel consumption by 2½% and requires the Comet to carry an extra 700-800 lb. of fuel instead of three more passengers. In a jet transport where fuel weight already eats heavily into payload, the loss of several passengers is a serious matter.

▶ **Without Automatics**—BOAC pilots operating without automatic controls, Pike said, are able to hold Comet airspeed within:

- **Five knots** (5.75 mph.) in smooth air.
- **Twenty knots** (23 mph.) in turbulence.

"There is a real operational need on jet transports for automatic pitch attitude and engine fuel flow controls" to maintain optimum airspeed, Pike concluded.

The British Smith SEP.2 autopilot, now used on BOAC Comets, operates to maintain the airplane at a level attitude (as do all conventional autopilots) rather than at optimum airspeed. (Several experimental military autopilots were tested in the U. S. in which the device deflects elevators to maintain constant airspeed rather than level attitude.)

In addition to automatic controls for pitch attitude and engine rpm., Pike favored use of autopilot approach couplers and other automatic devices that "increase the pilot's tranquility of spirit."

▶ **Pilot Requirements**—Capt. W. A. Jensen, an American Airlines pilot now assigned to the Air Transport Assn.'s Air Navigation and Traffic Control Division, defined a pilot's requirements for automatic equipment. Such devices, Jensen said, must contribute to flight safety, efficiency and comfort.

A pilot never would accept a co-pilot who frequently "kicked a hardover aileron," Jensen said, and the same requirement must apply to an autopilot. He added that an autopilot must fly the airplane as smoothly and comfortably as a human pilot would, particularly during turbulence. An autopilot and approach coupler that meet these requirements should increase the safety and efficiency of an ILS approach by relieving the pilot of some of his duties.

▶ **Pessimism In Design**—"We must have a high order of reliability if we are to tolerate automatic devices," Klein cautioned. The price of equipment failure may be an airliner crash costing $15-25 million in direct loss, claims, and lost revenue, he said.

Klein said engineers should look for possible simple mechanical solutions before resorting to automatic avionics devices. Before adding such devices, Klein warned, "we must analyze the possibilities and penalties of failure."

"The most reliable equipment de-

signs come out of pessimism," Klein said.

He said the "biggest trouble with electrical engineers is that they're not mechanical engineers." The result, Klein said, "is that the circuits work . . . but the mechanical parts fall off."

▶ **Draper Defends**—"Electronics has served as a convenient whipping boy when it is only partially at fault," Draper, director of M.I.T.'s Instrumentation lab and a leading authority on automatic control systems, said. "If we'd take the same care of electronics equipment (planning the initial installation, maintenance, etc.) as with the engine, fuel lines, and airplane," there would be no problem.

"An aircraft engine works much closer to the point of catastrophe than electronics equipment, which has more built-in safety factor," Draper said. Electronics equipment could be more reliable than any other part of the airplane if the designer were given more time and if size and weight were less critical. "We can trade weight for reliability," he added.

"Reliability is not necessarily tied into complexity," Draper said. As an example, he cited the present day automatic dial telephone systems which are much more complex but much more reliable than older manual systems.

▶ **Mating Airframe and Avionics**—Draper urged that design of airframe and avionics equipment be considered jointly rather than designing an airplane and then adding the "black boxes" as accessories.

Such joint avionics/airframe design coordination is being accelerated by the need for additional aerodynamic damping in highspeed jets, Harry J. Goett, of the NACA's Ames Aero Lab, indicated.

"The time is coming when artificial stability devices (yaw and pitch dampers) will become equal partners with aerodynamics," Goett said. (Dampers are avionics systems that resemble single-axis autopilots. They detect airplane yaw or pitch oscillation and displace the rudder or elevator to damp it out.)

The use of artificial stability devices offers several advantages to the airplane designer, according to W. F. Milliken, Jr. of the Cornell Aero Lab.

These include:

• **Changeable stability derivatives.** The use of an avionics damper permits the amount of damping to be changed easily and automatically for different flight conditions.

• **Eases airplane design.** The difficult task of designing supersonic aircraft is eased if the designer is able to call upon the damper to compensate for unforeseen stability problems.

• **Partial gust alleviation.** An attractive by-product of pitch dampers is that they provide partial gust alleviation.

NACA tests aimed at determining how little acrodynamic damping an aircraft can have and still be flyable have used damper systems set to decrease rather than increase the test airplane's stability. These tests have shown that pilots can fly aircraft with surprisingly little damping, but pilot fatigue

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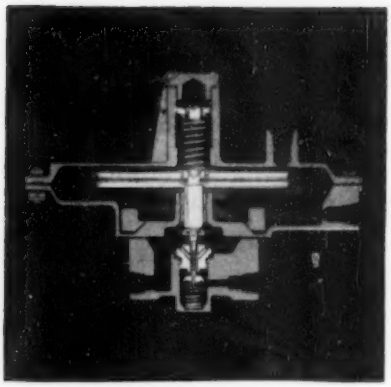
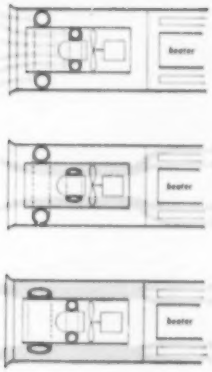
4

FUEL/AIR RATIO CONTROL



World War II stabilized the need for a dependable and efficient aircraft heater. In their efforts to supply this need, Janitrol engineers immediately encountered a number of variable conditions all directly affecting heater performance. Such things as plane speed, air pressure and temperature, size of aircraft, ductwork arrangement, exhaust restrictions, flight attitude, intake air scoop location, boundary layer conditions, had to be considered. Janitrol engineers decided that clean combustion should be the heart of the heater and they set to work on methods to maintain a relatively constant fuel-air ratio over a wide range of design requirements and service conditions.

This thinking led to the development of the air-loaded fuel pressure regulator, which varied fuel supply in relation to combustion air pressure. This approach solved the immediate problem, and in addition greatly simplified aircraft heater design and application. Today, this principle gives the aircraft designer maximum freedom in location of scoops and ducts while assuring proper combustion, efficient use of fuel, and ease of maintenance.



Latest thinking on air intake is incorporated in the inflatable air valves in the new Janitrol S-600 heater packages for the C-119H. Air intakes are both closed when the heater is off. Blower air intake opens automatically when blower is on. In flight, blower air is closed, and ram air open. This advanced development illustrates how Janitrol's experience in combustion engineering can go to work for you, most effectively in the design stage of your project.

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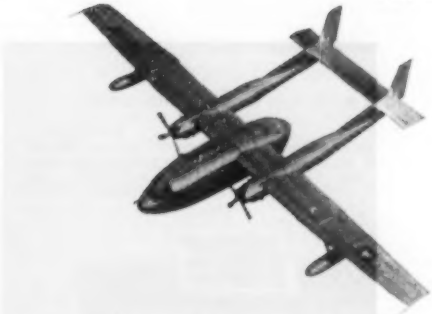

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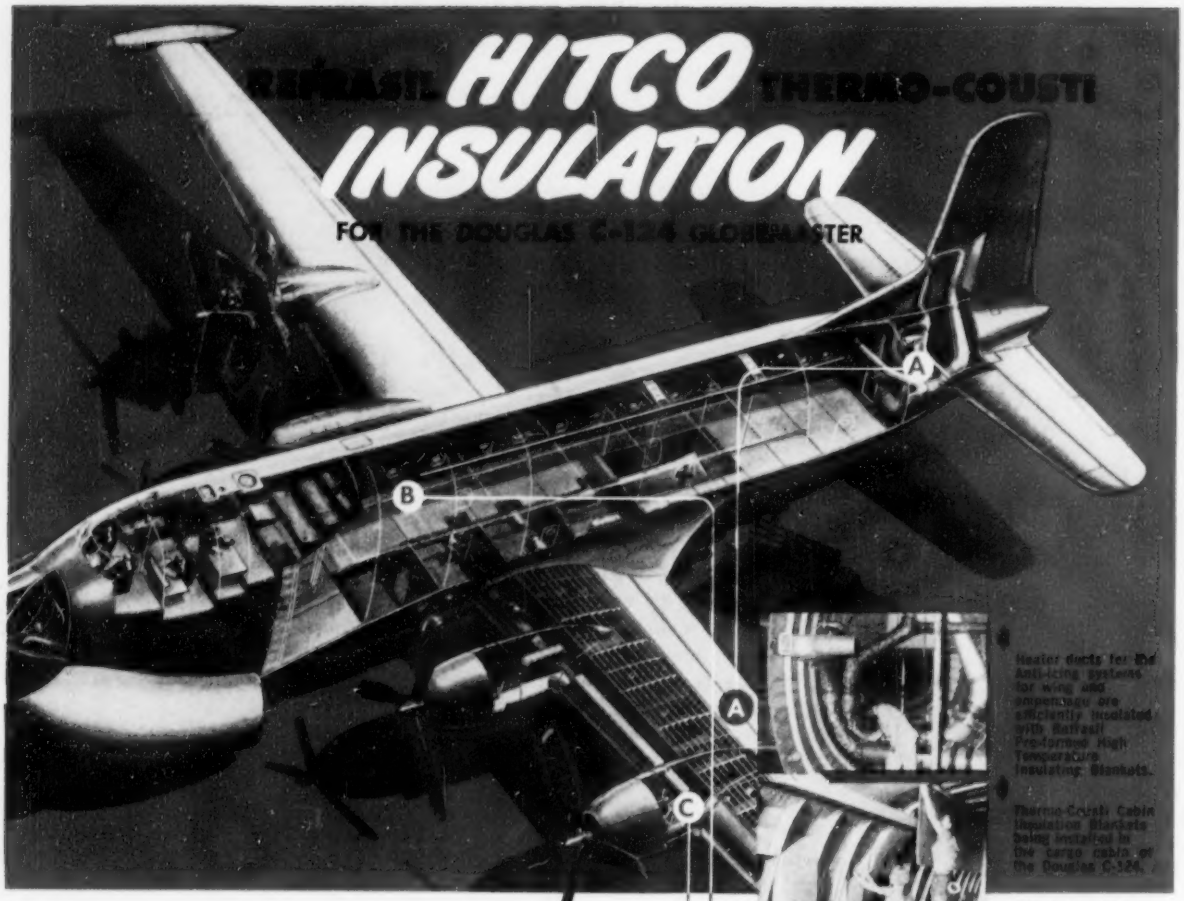
FOR THE DOUGLAS C-124 GLOBEMASTER



Heater ducts for the Anti-icing systems for wing and empennage are efficiently insulated with Refrasil Preformed High Temperature Insulating Blankets.

Thermo-Cousti Cabin Insulation Blankets being installed in the cargo cabin of the Douglas C-124.

Insulation performs a big job in the Mammoth C-124 Globemaster. This sky giant, designed and manufactured by the Douglas Long Beach Plant, depends on HITCO Insulating Blankets for efficient thermal and acoustical insulation.

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Note in the photo below the smooth, well-fitted appearance of Thermo-Cousti Insulation Blankets after installation in the C-124.

Photo at left shows Thermo-Cousti insulated enclosure for protection of engine nacelle maintenance personnel.

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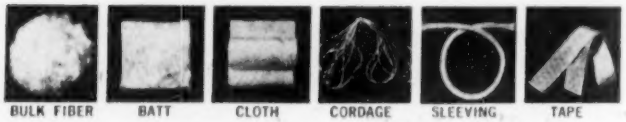

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goes way up under these conditions, Goett reported.

▶**Mission Reliability**—The need for "mission reliability"—ability of a military airplane to accomplish its mission successfully—has lead the Air Force to adopt automatic avionics devices wherever feasible, Brig. Gen. B. S. Kelsey, deputy director for USAF Research & Development, told the symposium.

In weighing the use of automatic equipment and the possibility of its failure, Kelsey cautioned, reduced mission reliability of the airplane without such equipment also must be taken into account. He said some World War II bombers were lost needlessly to flak because the airplane was out of trim and went out of control. The implication was that a small automatic trim-tab servo system might have saved the bombers.

Another example cited by the general, is the extremely precise intercept course fighters must fly in combat. Without automatic devices, with their attendant risk of failure, the fighter's mission reliability would be low.

▶**Systems Concept**—"Too many automatic devices are incompatible," Gen. Kelsey said, because they are designed as individual components rather than as systems. For this reason, the USAF has adopted a "systems concept" and now talks and designs "weapons systems," bombing systems," etc. As a result, there is "less and less distinction between the gadgets and the airplane," Kelsey said.

Automatic avionics devices can ease cockpit strain and fatigue, and the Navy is looking forward to the time when its pilots can "pay more attention to combat and less to instruments," Rear Adm. G. B. H. Hall, Fleet Air Wing, Atlantic Fleet, said. However, "much yet needs to be done before the Navy can accept fully automatic flight."

▶**Growing Importance**—Automatic pilots and their approach couplers came in for considerable discussion in the formal symposium presentations and during cross discussion and questions from the floor. Most likely explanation is the autopilot's growing importance and use in both military and the airline aircraft, and the fact that the autopilot typifies the more complex avionics equipments. Discussion highlights:

• **Bombing accuracy** has been improved greatly by tying in the bombsight and autopilot, Gen. Kelsey said.

• **Anopilot safety** has been improved by limiting servo torque or travel and by the use of monitors designed to spot autopilot malfunctions and disengage the equipment, panel member B. H. Ciscel of Minneapolis-Honeywell Regulator Co. said.

• **Servo forces** have been reduced so

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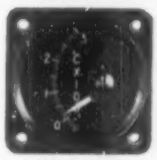
MODEL 17B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MODEL 77B dual, 2¼" case to AND 10403
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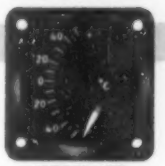
+30 to +230°F Oil Temp. . . .
+100 to +300°C Cylinder Temp.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much that the autopilot doesn't perform properly, Blake Chaill of Northwest Airlines remarked. "If this trend continues, autopilots might as well come out," he warned.

• **More human engineering** should go into the design of automatic controls, according to Gen. Kelsey. One step in this direction is the trend toward using the regular airplane control column or stick instead of a separate console controller to introduce maneuvers through the autopilot, Gen. Kelsey said.

• **Improved automatic ILS** approaches are possible if the autopilot and approach coupler do not try to maintain airplane heading, allowing the plane to "weathervane," panel-member Paul R. Adams, director of aviation development for Federal Telecommunications Labs, said.

▶ **Automatic vs. Pilot Control**—Though the proponents of automatic controls clearly outnumbered its opponents, in the symposium panel, several staunch supporters sounded notes of restraint:

• "A difficult pilot task does not in itself necessarily justify automaticity," B. H. Ciscel of M-H noted.

• "Automatic devices don't have the human's background of experience (to draw upon to meet unexpected situations) and won't for at least some time," Draper said.

• "Engineers (designing automatic controls) must be thoroughly familiar with the pilot's needs, and this should be supplemented by discussions with pilots to see how well these needs can be met," ATA's Jensen urged.

• "Many things which could be done automatically may be uneconomic," Gen. Kelsey remarked.

Panel member Klein, opponent of automatic control complexity, conceded that automatic devices are "necessary for military aircraft," and that the autopilot "will become a reliable device."

▶ **New Fields**—BOAC's Pike challenged avionics engineers to develop equipment that could:

• Warn of severe gusts and alleviate their effects.

• Warn of impending aircraft-to-aircraft collision.

• Execute a missed-approach procedure (raise flaps, landing gear, advance throttles, etc.) automatically when the pilot pushed a single button.

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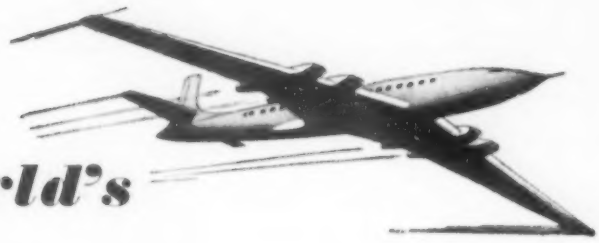
▶ **Course on Controls**—University of Michigan will run two one-week courses for engineers on automatic controls this summer. First starts June 15; advanced course, starting June 22, will include analog computer techniques. Registration closes Apr. 15. Write Prof. M. H. Nichols, U. of Mich., Ann Arbor, Mich.

▶ **New GE Control for Jets**—General Electric's new all-magnetic-amplifier jet engine control system, which automatically regulates fuel flow, engine rpm., tailpipe temperature, etc., is undergoing flight test evaluation at Edwards AFB. Older GE system, now in production for F-86D and B-47, uses vacuum tubes.

▶ **Mohawk TVOR At Ithaca**—The terminal omnirange (TVOR) originally installed by the Air Transport Assn. at the Baltimore airport for evaluation has been moved to Ithaca, N. Y., for trial use by Mohawk Airlines. Initial checks on the Ithaca installation reportedly showed bearing errors of 0.5 to 2.5 deg., except along the 150 deg. radial. When nearby trees are removed, Mohawk expects all errors to be under 2.5 deg.

▶ **Collins Goes To Mag Amplifiers**—Vacuum tubes used in Collins Radio's new experimental autopilot now under test (Aviation Week Nov. 17, 1952, p. 49), will be replaced completely by magnetic amplifiers in production design version. Collins will make change to get around airline objections to vacuum tubes.



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Lockheed Develops 'Giant' Techniques

- **Huge machines move into production pattern.**
- **Operation is bettered as more is learned.**

Progress in the aviation industry has demanded new production capabilities through specially designed machine tools.

An outstanding battery of machines for efficient production of large integral components is in Lockheed Aircraft Corp.'s "Hall of Giants." Plans for this special facility, outfitted to cope with tough production problems imposed by present design requirements and those anticipated for the future, were laid down about five years ago. (AVIATION WEEK Dec. 3, 1951, p. 20).

Pushed through its painstaking readying phase, the Hall has been stepping up its tempo for the past year and is now a vital part of Lockheed's production scheme.

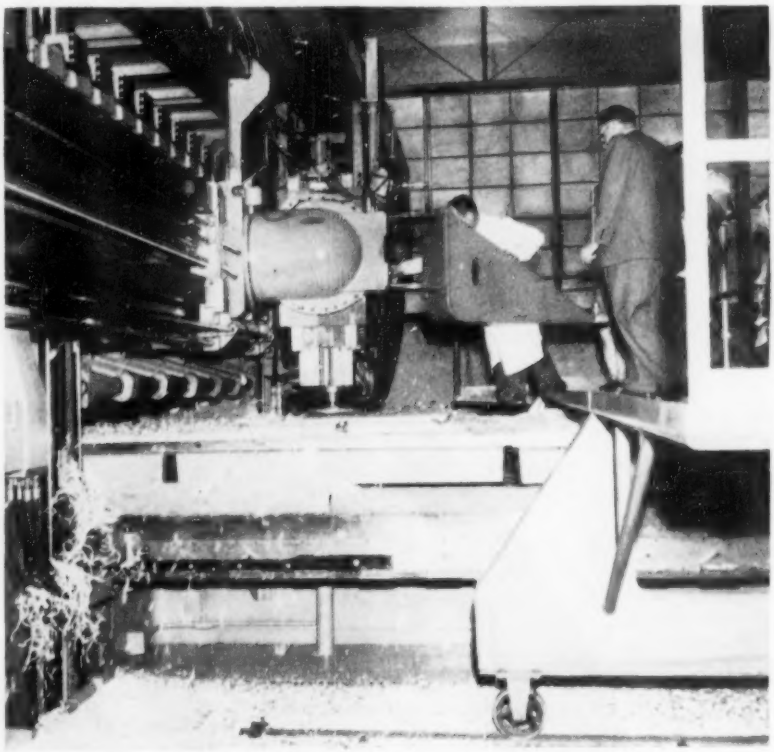
▶ **Stiffened Sheet**—The Hall's machines comprise a combination of giant tools in a coordinated lineup.

One of the key units is the Giddings & Lewis skin mill, specially built to Lockheed specifications, to turn out large, single-piece integrally stiffened wing sections from solid or rough-forged aluminum alloy slabs. It will cut, edge and shape, three-dimensionally, a particular pattern in the surface of a metal sheet.

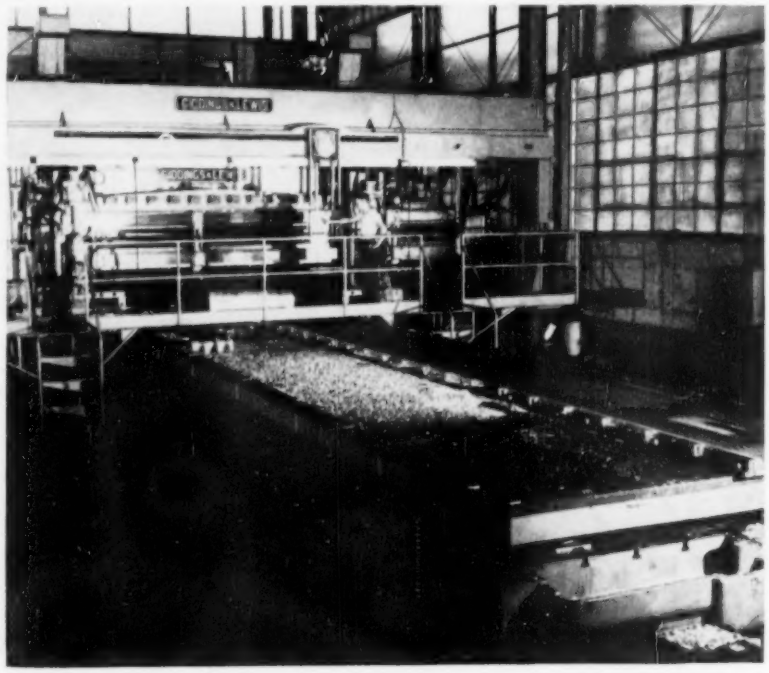
Techniques learned from early operation of the machine were instrumental in determining economic sizes for integrally stiffened sheet—destined to be a big factor in future design. Improvements in these techniques have steadily cut machining time.

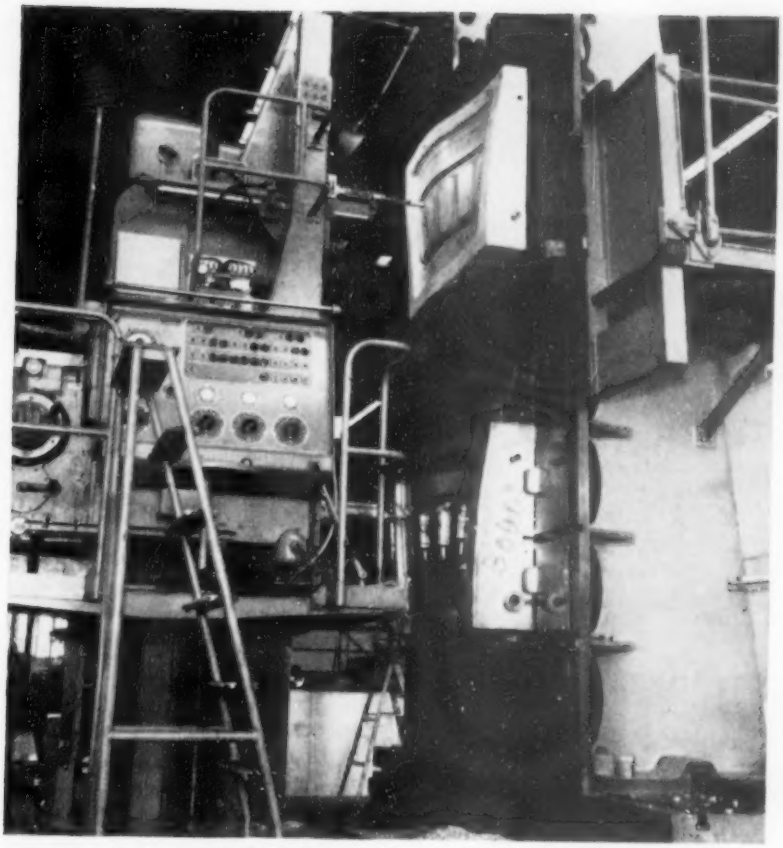
For example, the middle section of the Constellation's inner wing lower surface—an aluminum alloy panel measuring 32.8 ft.x48 in.x1¾ in.—required 60 hr. to machine when the mill was first installed. Time is now cut to 20 hr. Weight of the panel before machining is 3,300 lb., finishing up as a 389-lb. piece.

▶ **Big Savings**—Through this integral makeup on the three sections of the Connie 1049's inner wing lower surface, the saving in number of attachments—rivets, screws, bolts, nuts, etc.—totals 33,776. There are 1,472 detail parts also saved when compared with sections produced with conventional construction.

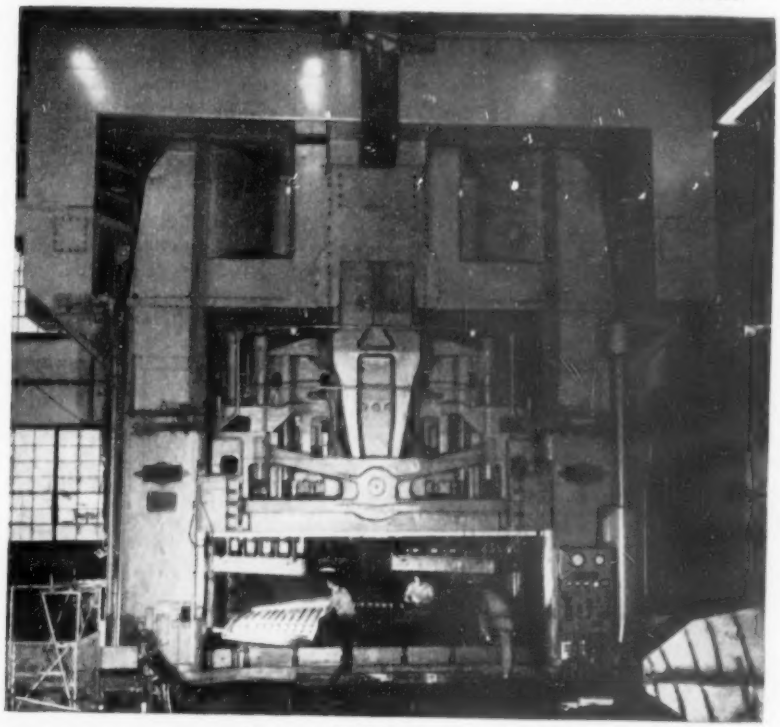


SKIN MILL technique has improved to the point where a 60-hr. job is now done in 20 hr. Mill can generate a carload of chips a day.





DUPLICATOR made by Keller produces dies of steel or Kirksite. Stylus on upper level follows pattern while tool on lower level cuts the die.



HEAVY PRESS turns out P2V Neptune nacelle doors two at a time, using double-action plastic dies in a 8,000-ton Birdsboro unit.

These three wing sections are lighter and stronger in the one-piece makeup. They have made possible an additional boost of 13,000 lb. in the plane's gross weight. The large-piece production also simplifies purchasing, handling and stocking.

▶ **Controls**—The machine is 18 ft. high, 30 ft. wide, 80 ft. long, and weighs 300 tons.

Flexibility of operation in three dimensions with two feed systems is obtained with a combination of electronic and hydraulic controls. A two-dimension electronic tracer control guides the longitudinal and lateral motions simultaneously; a vertical rise-and-fall cutting action controls variation in thickness. The machine works in a feed range of from ¾ to 150 in./min., with infinite intermediate speeds available between these limits.

Each of the three milling heads is powered by a 100-hp. motor. Spindle speeds up to 10,000 fpm. remove as much as 600 cu. in. of metal per minute.

▶ **Twelve Cutters**—Lockheed-designed carbide-tipped cutters vary in type and size according to the job to be done. Rotary end-mill cutters for sculpturing range from 6 to 10 inches in length, 1 to 2½ inches in diameter.

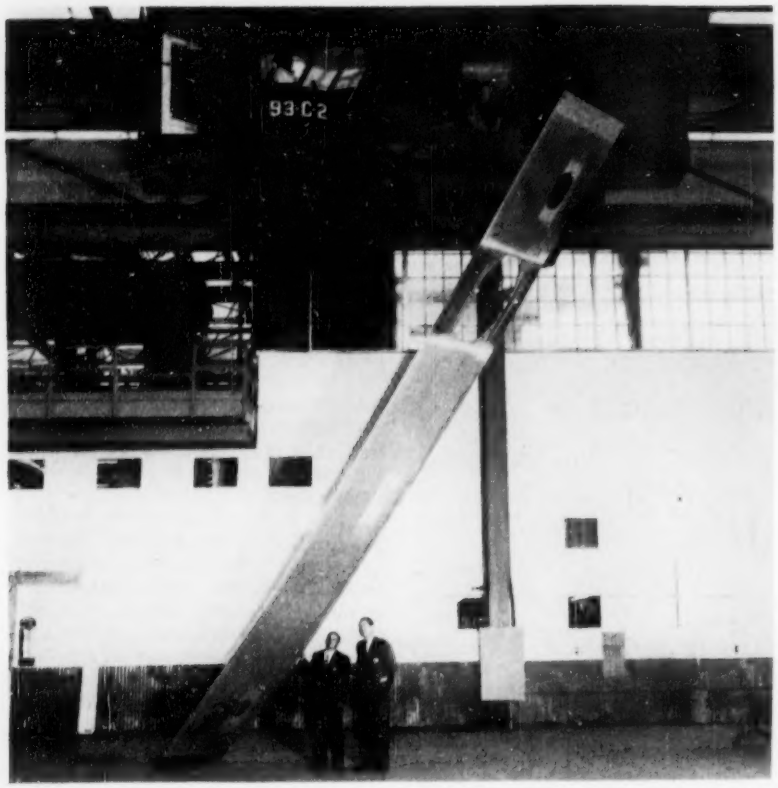
Milling cutters, mounted on a horizontal arbor, are 8 to 10 inches in diameter and can be mounted in a gang series up to 12 cutters wide. These are used in slotting operations on the integral stiffened sheet.

Because the skin mill can generate as much as a carload of chips in a day's run, it was not feasible to let these cuttings accumulate. A refinement to the machine now makes it possible to pick up about 99% of the chips from the vertical face mill. A special, venturi-shaped shield fits around the cutter, collects the chips and leads them to a conveyor arrangement feeding an elevator to an outside, overhead hopper.

▶ **Vacuum Refinement**—Trouble with the vacuum system installation for holding the work on the table was encountered during early operation of the machine. Flying chips and coolant shorted out the system's motor, causing shutdown and loss in vacuum which could result in work suddenly being thrown from the machine.

A new system, installed away from the machine, corrected this condition, with connection to the machine through a reel. An alarm system warns when vacuum drops below a safe value and automatically raises the cutters from the work.

▶ **Heavy-Work Press**—Another giant tool in the Hall is the 8,000-ton Birdsboro hydraulic press—considered the largest metal-drawing and blanking machine of its kind. It extends 36 ft. above floor level, 12 ft. below. Weight



LONG PANEL for Connie inner wing lower surface is turned out in one piece on the Giddings and Lewis skin mill. Panel is 32.8 ft. long.

is 2,373,000 lb. Table size is 30x6 ft., maximum opening is 7½ ft., maximum hydraulic pressure is 2,900 psi.

With this press, Lockheed has been able to form components that have never been formed before because of the combined difficulties of heavy metal gages and large tonnages needed, the company reports. Heavy, integrally stiffened skins and panels, wing leading edges and beams can now be shaped to exact contour.

▶ **Two at Once**—Wingtip tanks for the Super Connie are being turned out on the press. These units are formed in halves which measure 181 in. long, 44 in. across, and have a 22-in. depth of draw. Used in the operation is a 13½-ton plastic double-action die, believed to be the largest plastic unit of its kind in the airframe industry.

Lockheed's Methods Department made a survey of double-action forming jobs with the idea of reworking tooling on large parts for the press. It was found that in many instances, right- and left-hand parts of the same material and thickness could be run on the press simultaneously by making both dies the same height.

Setup and running time was saved, and it became possible to handle double the volume of previous presses, the company reports. P2V Neptune nacelle doors have been formed on the Birdsboro in right- and left-hand pairs, using double-action plastic dies.

For single-action forming, rubber platens are used. The press has used a rubber platen 5 ft. wide, 18 ft. long, 10 inches thick.

▶ **Giant Stretcher**—The Hall's stretch press is a 200-ton Hufford, for handling heavy skins and extruded pieces. Parts can be formed on the machine with such lengths and contours that the penalty of splices is avoided.

The jaws for gripping sheet are 72 in. wide, will handle material 6 ft. wide and 24 ft. long. Extra-heavy, 14-in. gripper jaws are used for forming extrusions. Lockheed has used the machine to stretch a beam extrusion 18 in. longer than the tool's maximum 24-ft. capacity, by using the smaller jaws from a 60-ton Hufford.

▶ **Hammer Stamp**—The facility's Chambersburg Ceco is reported to be the largest drop hammer stamp press in the industry. This 120x96-in. stamp will lift a 20-ton die and deliver a maximum blow of 321,000 ft. lb.

Lockheed says that the tremendous impact can form parts requiring twice the capacity of conventional drop hammers generally used in the industry.

▶ **Hydro-Tel, Keller**—A huge Cincinnati horizontal Hydro-Tel is another of the Hall's units. Particularly adaptable to development of integrally stiffened skins, this tracer-controlled machine will hold thin sheets to 120x432 in. while making cuts as much as 1½ in. deep.

The Hydro-Tel is used for milling integrally stiffened leading edge skins for the F-94C Starfire. These are made from ⅝-in. aluminum alloy plate measuring 60x108 in.

A big Keller duplicating machine is used to make dies of steel or Kirksite. The tool eliminates long hours of grinding time on castings by using an electrically controlled tracer to produce replicas from models. Range of the tool is 10x5 ft.

Other machines in the facility include a 30-ton die loader, special trimming mills, highspeed bandsaw and other standard tools. Overhead crane is a 30-ton unit.

▶ **Furnace, Degreaser**—On the equipment side, Lockheed has installed large units for accommodating materials in process.

One of these is a heat-treat oven with inside working dimensions of 5 ft. wide, 10 ft. deep and 32 ft. long. The furnace will handle a maximum load of 4,000 lb.

A transfer bridge shuttles the heat-treat rack from the loading zone, and permits a load to be held in readiness for moving into the furnace as soon as the latter is ready to receive it. Before Methods Engineering devised the shuttle scheme, delays were encountered between removing one rack-load and readying another to be set up and moved into the furnace.

A giant trichlorethylene degreaser treats all parts before they are routed to assembly lines. The unit can handle 12,000 lb. of aluminum per hour. Two holding baskets are coupled for the job. Each basket is 3 ft. wide, 10 ft. deep, one being 10 ft. long, the other 20 ft. long.

▶ **Ice Box Helps**—A 5,000-cu. ft. refrigerator, located at about equal distances from the major machines, keeps heat-treated aluminum alloys in a "soft" state between forming operations. It can cool 2,500 lb. of metal from room temperature to −20 deg. within two hours.

Refrigerator is 40 ft. long, 12 ft. wide and 10½ ft. deep. An overhead door, 34 ft. long and 4 ft. wide makes easy the insertion of components as large as the large inner wing panels for the Super Connies.

The refrigerator allows the processing of a large quantity of parts during a single period. Parts are worked out of the ice box to the machines as scheduling permits. Extra setup and press time is reduced for heavy equipment such as the Hufford, Birdsboro and Ceco, and parts breakage in forming operations is reduced.

—IS

Punch Press Scheme Can Save $1 Million

By switching from machining to punch-press production of stainless steel seal-enclosing ends for hot air ducts on the Scorpion F-89, Northrop Aircraft, Inc., expects to save $1 million in fabrication of the parts.

These ring ends—321 and 347 stainless material—vary from 1 in. to 5¼ in. in diameter. Because they had to be produced to extremely close tolerances, they were being machined from heavy wall tubing stock. Tubing of the right diameter and wall thickness was not always available and many of these parts had to be turned from solid stock. Overall, it was an expensive procedure.

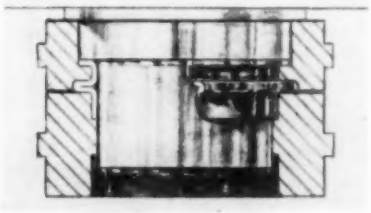
▶ **Old vs. New**—For example, a 5¼-in.-dia. duct end, when turned from 0.375-in.-thick tubing, required three hours to machine, with a loss of two pounds of stainless steel in scrap.

Northrop's tooling development department started checking and came up with cam action dies to form these parts in a punch press, using .035-wall tubing up to 2 inches in diameter or .035-in. strip stock welded into sleeves ranging up to 5¼ in. in diameter.

Using punch-press forming instead of machining has cut production time to less than five minutes per part. Because of the large number of these connectors used per plane, Northrop estimates the savings will run higher than $1 million.

▶ **Sequence**—In the new Northrop approach, strip stock is rolled into a sleeve, then welded on a steel mandrel with a copper insert preventing the weld from sticking to the mandrel. A clamp surrounds the strip but leaves the weld area clear. The sleeve is Heliarc-welded, with a little build-up at each end to prevent undercutting.

The mandrel and sleeve are removed from the clamp and placed on a pin for belt-sanding the excess weld flush



FORMING SCHEME: Dies (shown in cross-section) have bottomed; flange and bead have been formed in top die recesses. Top die next moves up, cams (not shown) hold dies closed when punch strips out of part. Dies then open, freeing part so it can be picked out with tongs.

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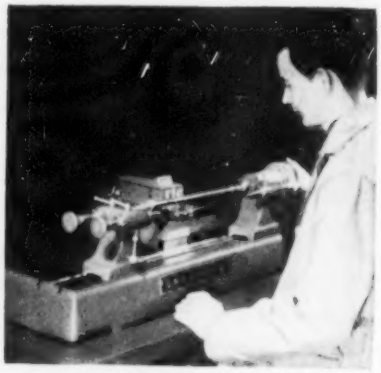
OLD & NEW: Former sequence (left) shows stainless steel tube, ring cut from it, machined part, and 2-lb. pile of turning scrap. New method's parts (right) show strip stock, welded ring, and resulting formed sleeve.

with the surface. The sleeve is forced from the mandrel, which has sized it within +.005 in. and −.003 in. diameter tolerance.

▶ **Control**—Before designing the forming dies, tests were made to determine the forming characteristics of the sleeves. It was found that a punch with an .090-in. radius for the sleeve to form against would easily turn the desired flange. Punches are provided for each different wall thickness to maintain a minimum space between punch and die to assure a flat flange and prevent sleeve wrinkling.

Each set of dies for the various diameter parts was developed to use the same width sleeves, so that one width of strip stock could be used for all sleeve diameters. Use of strip stock eliminates shearing and handling operations.



THREAD MEASURE

Lead of internal and external threads on parts with diameters up to 8 in. and lengths up to 18 in. is determined with this new instrument. It features a headstock with a micrometer barrel and a carriage with amplifying and indicating units giving 400:1 magnification made by the Sheffield Corp., Dayton 1, Ohio.

▶ **Bead Data**—Flange height is .130 in. and upset bead height is .180 in. maximum above the sleeve outside diameter.

Northrop found that heat was not necessary for bead formation. Better parts were made when they were worked cold. Although bead height is considered unusually high to be formed cold, it is within the elastic range of the material. The Heliarc weld is ductile and has given no difficulty.

Several types of lubricants were tested in connection with the new process. Best results were obtained with mutton tallow Northrop reports.

Northrop gives major credit for the production technique to its tooling engineer, Edwin A. DeVoss.

Navy Contracts

The following contracts were announced recently by the Navy's Aviation Supply Office, 700 Robbins Ave., Philadelphia 11.

AiResearch Mfg. Co., div. of the Garrett Corp., Los Angeles 45, maintenance parts for aircraft, $48,272.

Lockheed Aircraft Corp., P. O. Box 551, Burbank, spare parts for P2V aircraft, $95,462, $230,207.

Lewis Engineering Co., 339 Church St., Naugatuck, Conn., items of indicator and spare parts, 1,633 ea., $41,397.

Aerotherm Corp., Bantam, Conn., seat assembly, 77 ea., $47,953.

Eagle-Picher Sales Co., American Bldg., Cincinnati 1, pigment, red lead, 1,050,000 lb., $174,960.

General Electric Co., 1405 Locust St., Philadelphia 2, amplifier and maintenance parts for various instruments, $317,319.

Lear Inc., Romec Div., Abbe Road, Elyria, Ohio, pump assemblies for various aircraft, $161,861.

Hiller Helicopter Co., Palo Alto, Calif., services and materials for H-23 helicopters, $57,339.

Douglas Aircraft Co., El Segundo Plant, Calif., maintenance parts for AD aircraft, $53,300.

Jack & Heintz, Inc., 17600 Broadway, Cleveland 1, generator, tachometer and spare parts, 1,859 ea., $77,552.

Benson Mfg., 18th & Agnes Sts., Kansas City 1, Mo., fan assembly for HUP-2 aircraft, 144 ea., $288,382.

USAF Contracts

Following is a list of recent USAF contracts announced by the Air Materiel Command.

American Machine & Foundry, Leland Electric Co., Dayton, inverter assembly, 2,070 ea., inverter assembly spares, 1,035 ea., component spare parts, $1,222,027.

Bachman Wholesale Co., P. O. Box 237, Rochester, N. Y., servo assembly, 800 ea., $81,200.

Baldwin Lima Hamilton Corp., Philadelphia, 600-kw. power facility, 3 ea., spare parts, lot, pumps, fuel, oil transfer, 2 ea., $510,151.

Beech Aircraft Corp., 6600 E. Central Ave., Wichita, labor on aircraft, 2 ea., parts to overhaul airplanes, $37,000.

Bendix Products Div., Bendix Aviation Corp., South Bend, wheel and brake assemblies, $72,989, $2,665,739.

Brown & Mole, Inc., Strong Ave., Copiague, L. I. N. Y., carrier, 290 ea., $142,149.

Brown-Neil Corp., P. O. Box 2027, Clarksburg, W. Va., fire extinguisher, 87 ea., 36 ea., $45,156.

OK alternate angle cutters

slab-mill tough chrome-nickel-moly prop blades at Curtiss-Wright

JOB DATA

FEED *8.25 inches per minute*

SPEED *30 revolutions per minute*

DEPTH OF CUT *from 0.055 to 0.10 inches*

LENGTH OF CUT *123 inches*

STEEL *Chrome-Nickel-Molybdenum alloy*

CUTTERS *16 mounted 8 and 8 for straddle milling*

Climb-milling the taper on 25 x 123 x .800" chrome-nickel-molybdenum steel plates for the famous hollow-steel propeller blades used on big B-36 International Bombers is regarded as one of the more rugged metal-cutting assignments at the Curtiss-Wright Caldwell plant.

For this second operation, 16 OK alternate angle cutters straddle the center rib of the blade, 8 and 8, are mounted on a 75 hp planer-type miller. The taper extends 123" increasing from 0.055 to 0.10". The cutters are standard OK alternate angle mills with overlapping high speed steel blades. The angular set gives a shearing action, coiling and turning the chips away from the cut. Streamline in design, OK cutters are free from pins, screws, gibs and locks. They pack huskier blades for heavy cuts and more blades per body for finishing cuts. Blades are secured by a driving fit. Mated serrations in body and blades prevent any lateral movement and provide a fine scale adjustment to compensate for wear.

A copy of the OK catalog 13, "Modern Milling Cutters for Modern Milling Machines" is yours on request.

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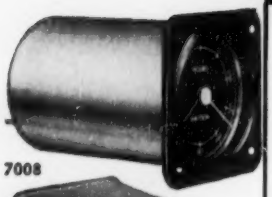
THE OK TOOL COMPANY, Milford, New Hampshire

TIMING DEVICES *for* MILITARY APPLICATIONS



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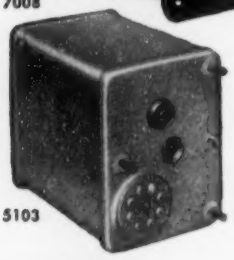

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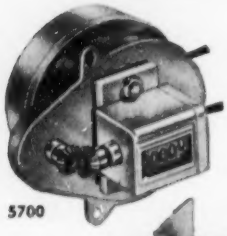

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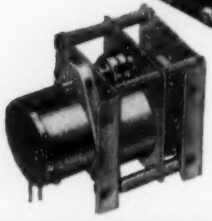

5148

HAYDON*, through research, development and engineering, is able to introduce timing motors and devices that offer major advances over previously available equipment. The 7008 Series Elapsed Time Indicator is an outstanding example. Designed specifically for 400 cycle operation in airborne equipment. Barrel diameter is only 1.525", is 2-45/64" long and it weighs only 6 oz. Power consumption is less than 3 watts and it indicates in units of tens of hours up to 10,000 and repeats. Write for Engineering Bulletin No. 4.

HAYDON 5700 Series Elapsed Time Indicators provide simple, compact and accurate metering of elapsed time for 60 cycle operation.

HAYDON 5103 Time Delay Relay is designed so that the synchronous motor performs its true function as a time standard. Switching work is accomplished by a relay coil, which, when energized, triggers the load switch for release at the end of the delay time. Write for Engineering Bulletin No. 3.

Series 5900 HAYDON Time Delay Relays provide time delay or interval timing in ranges from 0 to 10 minutes.

HAYDON 5148 Series automatic reset, D. C. timers are very versatile and can be used for either time delay or interval timing.

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General Tire & Rubber Co., 1708 Englewood Ave., Akron, wheel assemblies, 695 ea., 620 ea., spare parts & data, $80,510.

Heiland Research Corp., 130 E. 5th St., Denver 9, flash assembly, 288 ea., $65,589.

Illinois Institute of Technology, Chicago, architectural services, $50,000.

Liquidometer Corp., Skillman Ave. at 36th & 37th Sts., Long Island City 1, transmitter, 3,821 ea., $99,552.

Minneapolis-Honeywell Regulator Co., Minneapolis, components, spare parts, special tools and data, $618,400.

Royal Electric Co., Jamestown, Ohio, inverter, 980 ea., 666 ea., 1,293 ea., 50 ea., 29 ea., $1,884,741; $34,382.

Sylvania Electric Products Co., 254 Rano St., Buffalo, N. Y., drive assembly, $80,198.

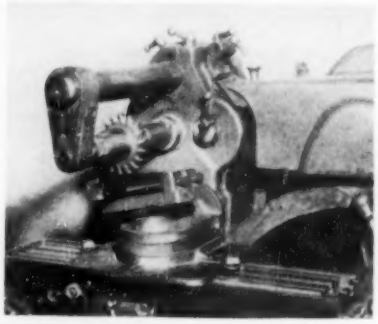
U. S. Gauge Div., American Machine & Metals, Inc., Sellersville, Pa., transmitter, torque pressure, 714 ea., $82,417.

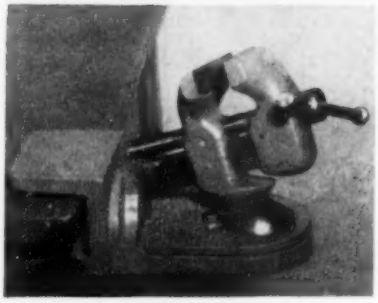
Wilcox Electric Co., Inc., 14th & Chestnut Sts., Kansas City 1, training program, $50,000.

Wollensak Optical Co., 850 Hudson Ave., Rochester, N. Y., camera, 15 ea., 25 ea., control unit, 24 ea., $86,160.

Northrup Expansion

Northrop Aircraft, Inc.'s flight test and modification facilities at California's Ontario International Airport are being expanded under USAF contract. New buildings with a total area of 60,000 sq. ft. will provide additional facilities for modification of the company's Scorpion F-89 as well as painting and stripping activities, equipment storage, and administration services. Occupancy is expected before May 1.

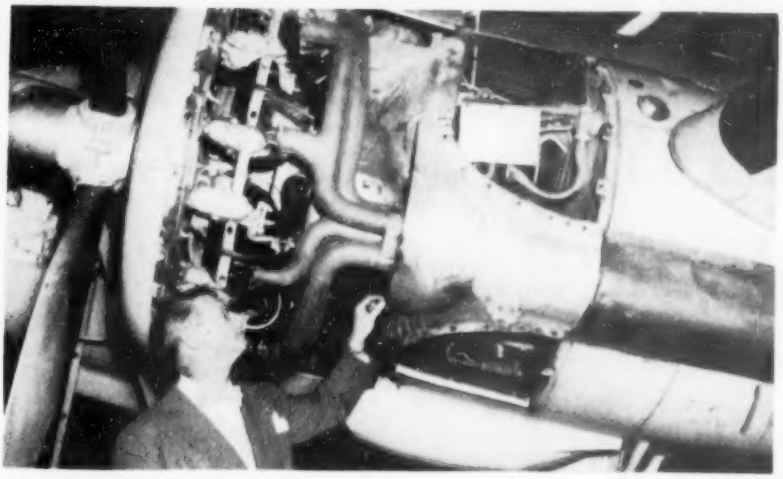




THIRD HAND

Small hand vise serves as a "third hand," can be used for all-around work-piece holding jobs and to speed up machine tool operations. It can be placed in difficult locations, set at odd angles, has special surface grinding attachment for machine tool work. It sells for $39.95, complete. Bellows Mfg. Co., Dallas.

EQUIPMENT



NEW JET-EXHAUST COWL which reduces engine back pressure is one way that . . .

Lear Raises Lodestar Performance

Greater speed, range and efficiency are claimed for Lockheed Lodestars modified according to designs developed by William P. Lear. CAA certification of the design changes is expected in the very near future.

Lear, head of the company bearing his name, told AVIATION WEEK that his Lodestar, which normally cruised at 220 mph. (around 55% rated power), now has the following performance:

- **235 mph. at 47% rated power.**
- **253 mph. at 53% rated power.**
- **275 mph. at 64% rated power.**

Stated another way, gains are: 25% range increase at 230 mph. at 11,000 ft. altitude; or, approximately a 32-mph. speed increase at 100-gal.-per-hr. fuel consumption.

Lear looks for a cruising speed of 280 mph. at 56% power when his modification program is completed.

▶ **Lodestar Changes**—Here are the changes Lear is making on his Lodestar:

- **Jet exhaust cowl** with siamese stacks has been installed. The "jet" effect of exhaust gases increases the plane's speed. Siamese stacks materially reduce exhaust back pressure on engine, increasing its power output.

The new arrangement mechanically disconnects the engine from the airframe, reducing amount of engine vibration transmitted through the nacelle to the airframe. This should decrease deterioration of the latter due to vibration, and exhaust system life should be prolonged.

Under the original Lodestar configuration, the engines' exhaust system was rigidly attached to the nacelle, providing a path for vibration transmission.

Exhaust heating has been changed to a simple-to-install combustion heating system that gives more heat in the winter and increased ventilation and cooling in the summer, says Lear.

A cowl flap has been cut in the upper surface of the new, tight-fitting, streamlined engine cowl to provide adequate engine cooling.

- **Removal of the "bat wing,"** approximately a foot of wing trailing edge, pushes the craft's speed up 9.5 mph., with no deterioration in performance, Lear reports. He adds that bat wing lift effect at takeoff may be obtained by using 10% flaps.
- **Tip tanks.** Beefing up outer wing panels will permit installation of 165-gal. wingtip tanks. End-plate effect of the tanks will reduce drag appreciably.
- **Retractable tailwheel.** Lear devised a retracting mechanism to tuck the Lodestar's tailwheel inside the fuselage. Pulling it out of the airstream should boost the plane's speed another 4-6 mph., Lear says.

Lear says he is building a number of new wings and tip tanks as replacement for old-style wings. Complete cowl assemblies will also be available as soon as certification test requirements have been approved by the CAA.

Veteran flyer Clyde Pangborn is engaged in the engineering test flying for these modifications and Aero Conversion Engineering Corp. is doing much of the engineering work on the new wing and retractable tailwheel.

Reflecting Runway

Reflecting tape, instead of lights, will outline the runways at the new Phoenix, Ariz., airport. Mel Harrison, the airport's maintenance supervisor, is credited with the idea of using tin cans covered with the tape for marking. Aircraft lights reflected from the cans will outline the runways.

The airport says more than 400 have been installed at a system cost of $500, compared with an estimated $35,000-$50,000 for regular-type runway lights.

Chennault's Airline Flies Its First DC-4

Civil Air Transport, Gen. Claire Chennault's Formosa-based airline, recently put its first four-engine aircraft into service. CAT expressed pride in the DC-4 in these words: ". . . a plushy inside, a fine looking outside and four beautiful fans . . . two on each wing." Four-engine equipment is an uncommon luxury in the Far East.

The 42-seat transport, bearing the Chinese marking B-1002, will permit CAT to operate a seven-hour, non-stop schedule between Taipei and Tokyo. The carrier's C-46 Curtiss Commandos make the flight in 10 hr. 15 min. with an hour's stop at Naha, Okinawa and a possible flag stop at Iwakuni, Japan. The DC-4 also will service CAT stations located at Pusan, Korea, and Hong Kong.

The airline painted rectangular lines around the plane's oval cabin windows, which gives the craft the appearance of a DC-6.

OFF THE LINE

Rohm & Haas' Plexiglas 55, new modified acrylic glazing material, is now being used for B-47 Stratojet canopies. Plexiglas 55 has the same ultraviolet light absorbent properties as Plexiglas II(UVA). Charts appearing with recent article on the material (AVIATION WEEK Jan. 19, p.53) showed UVA properties of Plexiglas I-A and II. Design, Fabrication and Molding Data Sheet 64A, available from R&H Plastics Dept., Washington Sq., Philadelphia, contains charts showing ultraviolet light transmission characteristics of Plexiglas I-A, I-A(UVA), II and II(UVA).

A tooth paste tube manufacturer is turning out main landing gear plunger tubes for the Cleveland Pneumatic Tool Co. to go into the completed shock strut of a jet fighter plane.

PROSPERITY IN THE USA: How Deeply in Debt Are We?

How prosperous *are* the people of the United States? Previous messages in this special series have answered this question in part by recording the progress – relatively slow progress – we have made in increasing both the income and the wealth per person in the USA.

This fourth and concluding piece of the special series deals with the extent to which our prosperity should be discounted because it has been accompanied by an increasing volume of debt. Many correspondents have suggested to us that an individual or a nation can temporarily increase prosperity by borrowing, but in so doing lives on both borrowed goods and borrowed time. Our purpose here is solely to throw light on the question of whether or not we are now in that unenviable position.

On January 1, 1953, the total debt of the United States government and of its citizens was $627 billion, as shown in the table below. On its face, a debt of this magnitude, which represents about $3,900 of debt for each person, suggests that we are heavily debt-ridden.

TOTAL DEBT – PUBLIC AND PRIVATE

Federal government debt	$267	billion
State and local debt	30	"
Private debt		
Corporations	195	"
Individuals	135	"
	$627	billion

The burden of our debts, however, does not depend simply on their size. It depends in much more decisive degree on our capacity to carry the load successfully. This capacity, in turn, is partly a matter of attitude, and attitudes defy objective measurement. A community that gets very jittery about its debts has less capacity to carry its burden successfully than one that does not. But the accurate measurement of jitters, present or prospective, still remains to be mastered.

Capacity to Carry the Debt Load

Nonetheless, it is possible to throw some light on our capacity to carry the debt burden by studying key economic elements that can be measured with some degree of accuracy. The following paragraphs indicate how some of these key economic elements stand.

Compared with our national income, the total volume of our debts, public and private, is still well below the level of 1929, when it proved to be too big for the good of the country. Our total debt is now 113% greater than the national income whereas in 1929 it was 146% greater.

There are several other cheering facts about our debts. One is a sharp decline in interest rates which makes the cost of carrying our debts relatively much less than it was in 1929. It took 8% of our total national income to carry our debts in 1929; it takes only about 5% of the income today.

More Cheering Facts

We also have much more ready cash now than in 1929. Today individuals and corporations hold a total of $269 billion in cash or its equivalent which is almost twice as much as the portion of private short-term debt (about $140 billion) that is subject to sudden demand for payment.

Many students of the subject cite the relatively low cost of carrying our debts and the large volume of cash on hand, and reach the comfortable conclusion that our debt burden is nothing to worry about. In further support of this view they emphasize the fact that no important part of our debt is owed abroad. Hence, they reason there is not the danger, so conspicuous in Britain since the end of World War II, that our economy will be upset by the necessity of making heavy debt payments to other countries.

Some Dangers of Present Debt

However, the nature of our debts presents dangers that it would be foolish to ignore. This is true of both the debt of $267 billion owed by the federal government to its citizens and the $330 billion in private debts owed by some citizens and corporations to others.

Public debt can be a dangerous kind of debt because government has the power to print money or to create its equivalent by expanding bank credit. Of the $215 billion that the federal government borrowed during World War II, over $90 billion was borrowed from banks. This was the largest single contributor to the inflation of prices that since the war has robbed the dollar of about half of its purchasing power, and thereby robbed the buyers of government bonds of about half the purchasing power these bonds were supposed to represent.

If, as is quite possible, a new emergency should again require the federal government to borrow heavily while its debt remains so high, it is doubtful that the public would be avid to buy its bonds. Hence, the government might again be forced to resort to the inflationary process of relying on bank credit.

Private debts can be dangerous if the people take on new debts more rapidly than is justified by the growth of business or by their ability to repay. Last year bank loans were increased by the imposing sum of about $6½ billion, which represents an increase of about 11% in total loans outstanding. This is almost twice as much as the increase in the volume of business over the same period. Installment credit for consumers increased by $3 billion last year, again an increase in debt about twice as great as the increase in business volume in the fields where the credit was used. It is also the fastest rate of such growth in our history.

Constructive Use of Credit

So long as the expansion of credit does no more than keep pace with expansion in the volume of business, the expansion is constructive. Also, when credit is expanded to acquire resources and equipment that will enlarge the volume of business a little later, that use is clearly constructive. But when private credit expansion begins to run ahead of business growth, it is time for us to be heads up. Such credit expansion courts price inflation. It also creates a forced draft under business so that, if credit is cut off, there may be a painful drop.

To give a summary answer to the question: *Is the level of debt in the United States a danger to our prosperity?* — the answer seems to be, "Not at the moment." We owe nothing abroad. The interest burden on present debt is relatively small, and we appear to have the resources to handle the short-term debt. Yet both the total amount of debt and the recent rapid increase in total private debt, especially the latter, are enough to signal for caution. We need restraint on the part of business and consumers to avoid expanding private borrowing at an excessive rate. The federal debt needs to be reduced and put in more manageable form. If these things are done, we can proceed to build a sound prosperity.

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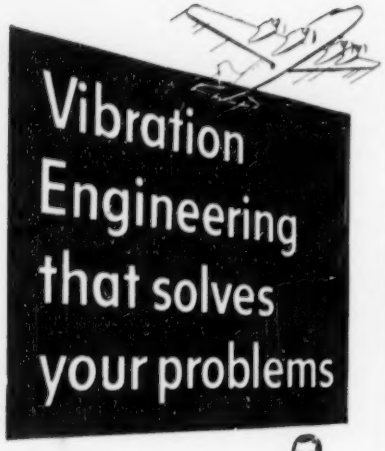

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A self-insulated terminal with a molded nylon jacket for the largest sizes of aircraft electrical cable (up to 4/0) is said to save $200 in an average fighter plane wiring job. The Sta-Kon terminal feature cuts installation steps from seven to two, the manufacturer, Thomas & Betts Co., says.

The funnel-shaped interior of the jacket's shroud automatically guides the many fine strands of cable into the terminal and is said to insure a well-insulated joint with maximum electrical capacity. The nylon insulation resists the chemical action of aircraft hydraulic fluids. Terminal's compactness permits installation in restricted areas where leads are crowded or overlap, as is the case in aircraft control wiring.

All that is required to install the wire is insertion of the cable and its staking in the terminal. Since it is an integral part of the terminal, the nylon insulating sleeve is already in place.

Thomas & Betts Co., Elizabeth, N. J.

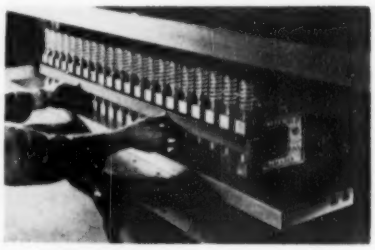
Dye Penetrant

A dye penetrant packaged in pressure cans, said to aid in the location of cracks in any solid material, can be employed to check overhaul of metal aircraft parts, according to its manufacturer. The material, Spotcheck, is available as part of a kit prepared to simplify the operation.

Not intended for extensive operations, the product is designed for inspection of local areas of large parts or to check remote locations where only a few parts need be tested.

The penetrant is sprayed on by hand in the manner of air-propelled insect killers. Following application of a cleaner, which is immediately wiped from the surface, a white developer is applied. Cracks in the material are indicated by bright red lines; pores or leaks in tanks appear as red spots.

Magnaflux Corp. 5900 Northwest Highway, Chicago 31, Ill.



Hole Punchers

Independent, clamp-shaped punch-and-die units that can be used to hole sheet metal and plate in a wide variety of patterns, have been developed by Wales-Strippit Corp.

Each of these CJ Hole Punching Units includes a punch, die and stripping mechanism, assuring permanent alignment of punch and die.

Setups are made on T-slotted plates or rails which then are secured to the bed. As punches are retained with the dies in the independent holders, no attachments to the ram are required.

Wales-Strippit Corp., N. Tonawanda, N. Y.

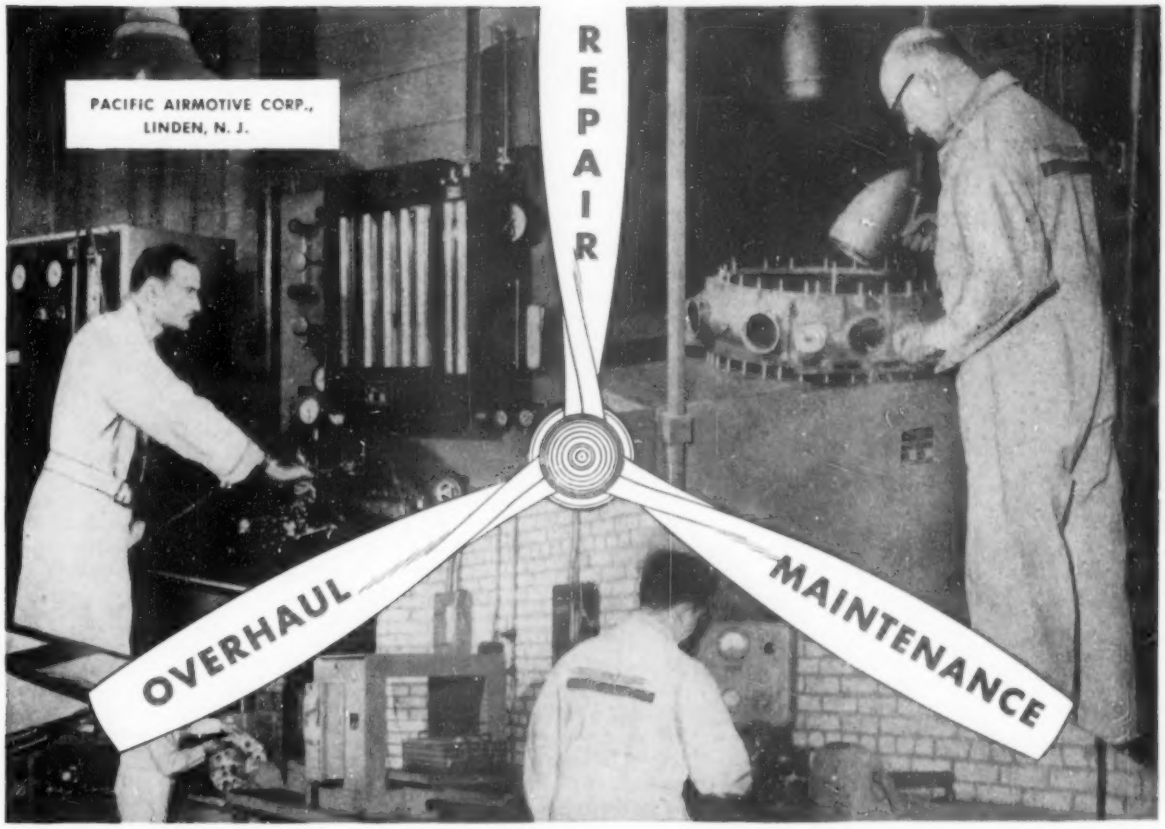
Resin Coating

X-5, a new resin coating that adheres to metal surfaces, including alloys of copper, steel, aluminum and magnesium, has been announced.

An important aviation application may be in its use as a primer for metal-bonding agents, as the company says it greatly improves adhesion of bonding materials, raising their strength.

Applied from solution, X-5 develops a black coating from .0005 to .001 inch thick. It is cured by baking for an hour or so at 330F or for several minutes at 500F.

Furane Plastics Inc., 719 W. Broadway, Glendale 4, Calif.



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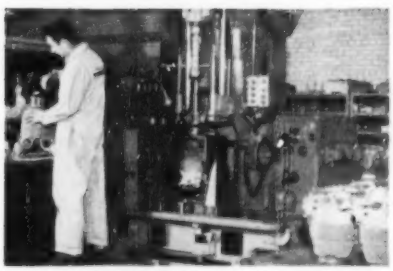

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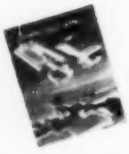

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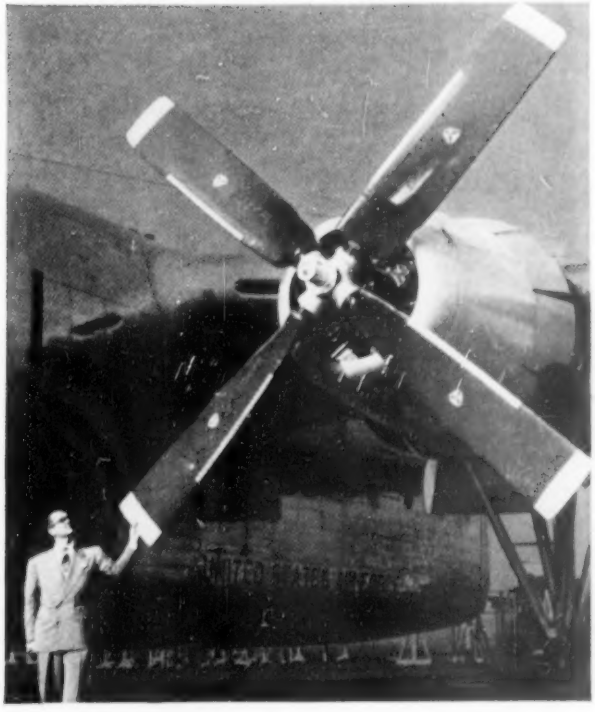
AEROPROPS BOOST PACKET PAYLOADS



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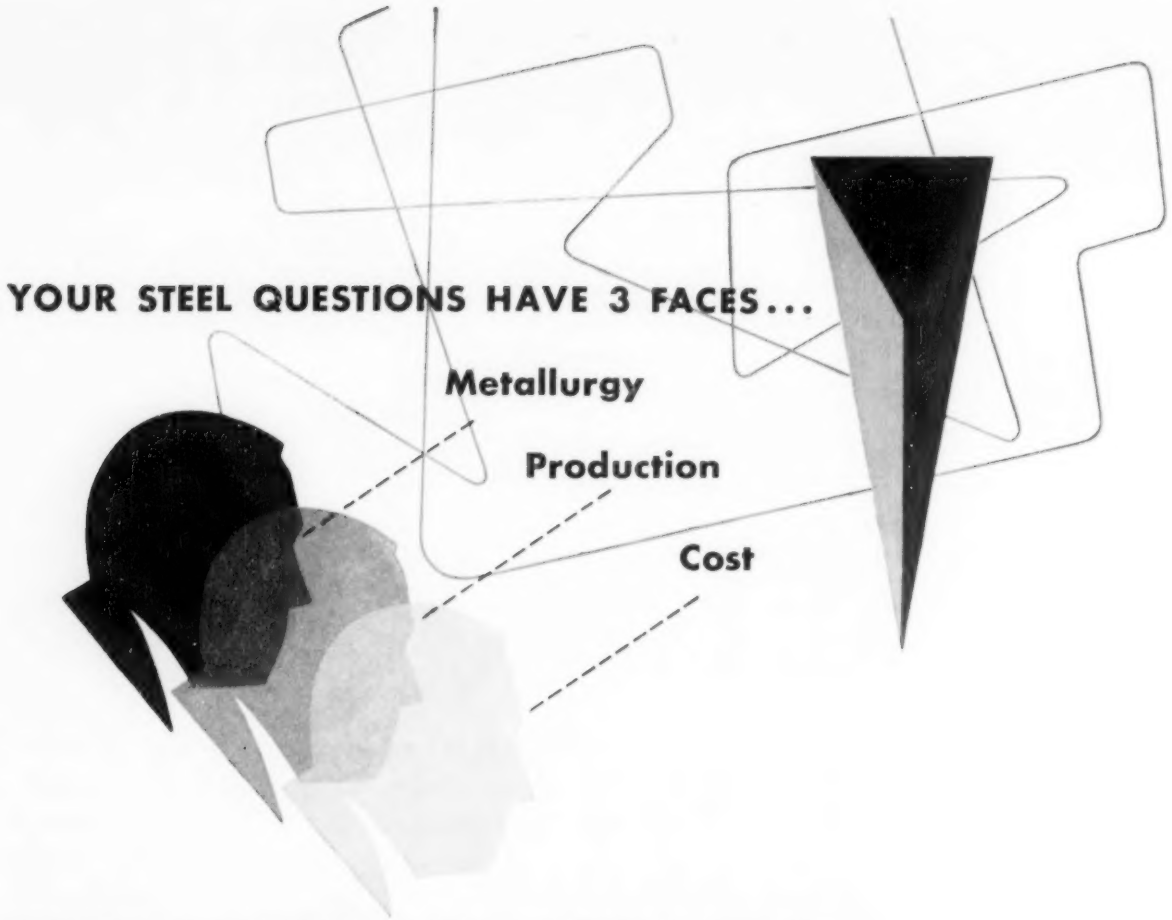

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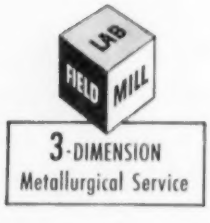

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Pan American Details Jet Transport Needs

- **PAA official urges early U. S. turbine airliner.**
- **Comet flight experience cited as aiding British.**

Transition from piston to jet-powered transports will be a change for the airlines comparable to the switch from sail to steam in the merchant marine of a century ago, says John Borger of Pan American World Airways.

Borger, who is PAA's chief project engineer, has no doubts that the commercial jet transport is here and here to stay. But he warned a New York meeting of the Society of Automotive Engineers that its successful application offers a new goal for air transport engineering that must be achieved.

"Our customers of the future will not be interested in the problems of jet transports," Borger said, "only in the solutions. If we of U. S. aviation do not offer the solutions, it is to be expected that others will."

▶**PAA View**—Pan American feels that the advent of jet transport represents a significant change in air transportation and that it is important to begin acquiring knowledge and experience with jet liners as soon as possible. Borger predicted that the number of jet transports in airline operation would be quite small for some time in relation to piston-powered airline fleets. He warned against underestimating the value of operational experience accumulated by relatively small numbers of jet transports which will be in service in the immediate future.

"The important point is that the British have the airplane in operation today," Borger said. "You can talk about American operating know-how, design know-how, production knowledge, research facilities and any other type of approach, but the pay-off comes from actual operating experience.

"Specifications, drawings, design studies, cardboard and plywood mockups are no substitute for an airplane a crew can step into and take off. Bugs and troubles are bound to develop . . . but by the time any American operator flies a jet transport in regular service, BOAC, (British Overseas Airways Corp.) should have more than four years operating experience with the Comet 1 and 2 and other operators will also have acquired experience with the Comet."

Piston vs. Jet Performance

(Typical San Francisco-Honolulu operation)
(2,115 nautical miles)

	DC-6B	DC-7	Comet 3	
Maximum takeoff wt. .....(lb.)	107,000	122,000	145,000	
Passengers	56	60	60	
Payload .....(lb.)	14,300	16,500	15,300	
Block time				
Westbound .....(hr.)	9:15	8:00	6:00	
Eastbound .....(hr.)	8:27	7:12	5:15	
Roundtrip* .....(hr.)	21:42	19:12	15:15	
Fuel consumed .....(lb.)	42,140	44,376	98,600	
Roundtrip .....(gal.)	7,140	7,520	14,730	(14,230)**

Types of Fuel

			Light	
Grade	108/135	115/145	Kerosene	Diesel
Fuel cost .....($)	.205	.205	.135	.125
Density .....(lb./gal.)	5.9	5.9	6.7	7.0
Fuel: lb./mile	8.65	9.09	20.2	20.2
Gallons/mile	1.47	1.54	3.02	2.92
Dollars/mile .....($)	.300	.316	.408	.365
Relative speed .....(percent)	100	107	145	145
Relative fuel cost .....(percent)	100	105	136	122

*Includes 4 hours layover.
**Parenthesis light diesel.

▶**Prophets Wrong**—Borger warned against undue pessimism in the development progress of jet transports. He predicted jets eventually would achieve even better airline productivity than conventional transports. He referred to a study made in 1939 by "experts" proving any airliner that flew faster than 200 mph. would be "uneconomical" and cited competent industry opinion of 10 years ago that questioned whether a 300-mph. transport could be operated at fares competitive with the 200-mph. plane.

John Borger

Borger said the jet transport's appeal to airline customers is based on two factors: speed and comfort. He listed the following problems in future jet transport development:

• **Fuel.** Further exploration of energy content and cost of various type fuels should offer major economies in jet transport fuel. Substitution of light diesel oil or No. 2 home heating oil for kerosene now burned by Comets would produce annual savings of $150,000 on a San Francisco-Honolulu run of 2,115 nautical miles operated twice a day. Use of heavier fuels with lower cost and more BTU per gallon would require additional jet engine development to obtain burner cans adaptable to the new fuel and would require heating applied to the fuel system to keep a steady flow of heavier fuel from tank to engine.

• **Engines.** Trend in modern transport design already evidenced by the Super Constellation and DC-7 is to get higher performance primarily from power increase rather than aerodynamic improvements. This trend will become more pronounced in jet transports. Because about 75% of service troubles with new aircraft are located in and around the powerplant, the development of jet reliability is a prime problem. Increase

How Jet Designs Save Time

(Total Flight Time)

	Current best schedule	Comet 3	Advanced jet designs
New York-London	11:55*	8:35*	6:00
London-New York	16:25*	12:15*	8:00
San Francisco-Honolulu	10:15	6:00	5:20
Honolulu-San Francisco	8:45	5:15	4:30

* Not non-stop. Allowance for ground time included, 30 min. per stop domestic, 45 min. international.

of jet engine overhaul from 500 to 1,000 hr. would reduce operating costs per seat-mile by about 15%. Further reductions can be made by replacing fewer parts during overhaul. Trend toward more engine service activity between overhauls will help to extend overhaul intervals.

• **Design.** Jet transports should be designed to be as fast as possible up to the drag rise limits of compressibility. Features such as swept wings, thin airfoil sections, and high cruising altitudes will contribute to operating economy. Low unit costs can be shown for slower aircraft, but revenue-attracting quality of the fastest aircraft outweighs this factor in considering overall airline economy. Faster aircraft also achieve greater utilization and can fly more revenue-producing miles per day than slower types.

• **Size.** The jet transport must be large enough to carry a big revenue-producing load. The easiest way to reduce seat-mile costs still seems to be combining the largest number of seats in the smallest possible fuselage. High initial operating costs of jet transport indicate large passenger capacity will be required for economic operations.

• **Flexibility.** Jet transports should offer flexibility in their load-carrying ability. The convertible cabin interior developed by Pan American on its Stratocruisers and DC-6Bs should be applied to jet transports. Rail seating to permit quick interior conversion from high-density arrangements to Sleeperette service already has been specified by PAA for the Comet 3.

• **Range.** For better operating economy, jet transports should have more range than the current Comet series. For maximum efficiency, jet transports should be designed to operate nonstop between key traffic-generating points along their routes.

Propeller Reversed in NEA Crash

Right propeller blades of Northeast Airlines Convair 240—Flight 825—which crashed at La Guardia Field, N. Y., Feb. 6 were found to be at approximately —.3 deg. pitch, indicating the pilot had experienced an unwanted reversal during landing. This finding was brought to light during the official Civil Aeronautics Board investigation of the incident at the Hotel Lexington in New York City.

Flight 825 originated in Boston and the incident occurred at approximately 7:50 p.m., just prior to touchdown on Runway 13 (AVIATION WEEK Feb. 16, p. 18). None of the passengers or crew was seriously injured although the plane suffered extensive damage.

However, none of the investigators who analyzed the wreckage came up with any findings on what might have caused the unwanted reversal.

Since the crash Northeast has initiated a rewiring program to isolate the prop reversing circuit completely from the propeller dome to the control pedestal. The props on the NEA Convair are Curtiss model C632S-B352.

CAA safety agent maintenance, E. W. Keeler, Boston, Mass., testified that the prop motor and brake assembly fitted to the NEA Convair's right engine had been one of the components fitted to the left engine of an NEA Convair 240 which suffered an unwanted propeller reversal on the left side at Portland, Me. Apr. 15, 1951. But he found no indication of malfunction of the unit to tie it to the latest incident.

The pilot, A. V. R. Marsh, who has some 3,100 hr. command pilot experience on the CV-240, testified the flight had been without incident until he was approximately 100 ft. above the airport and coming in for a landing. Throttles were a little above the idle position. Then there was a sudden yaw coupled with an unfamiliar loud noise that he could not immediately identify. He stated he momentarily advanced both throttles, but when the yaw and noise increased, pulled the throttles back. It was then he felt that he was experiencing an unwanted right prop reversal and the aircraft was not responding to his control. Before he could attempt further to correct his position, the right wingtip, then the landing gear, hit the ground and the plane went off the runway and skidded along the grass. The right wing tore off and settled against the fuselage.

Under questioning, Marsh and his co-pilot, Capt. E. P. Rooney, stated that they felt reversible props were a worthwhile safety device, "in lieu of longer runways." They both strongly recommended that a warning-light indication should be installed to notify the pilot when his props are starting into reverse. This should be combined with a one-motion method of getting back to positive pitch, they agreed.

Northeast, working with Curtiss, has modified its prop reversal system following the Apr. 18 incident in Portland, which was traced to a sneak circuit (short). The reverse slip ring was isolated further and the prop feather circuit was reworked so that it would over-ride all other circuits in an emergency, such as an unwanted reversal.

The fact that the 240's cabin had gone dark following the crash came up for discussion a number of times during the hearing. The 240 crew, Air Line Pilots Assn. representatives and at least one of the passengers stated an emergency cabin lighting system actuated by impact switches should be incorporated in airliners to assist in evacuation.

NEA vice president-operations A. A. Lane indicated to AVIATION WEEK that the carrier has been investigating this proposal for some time but has not yet seen a satisfactory unit. He said that this incident undoubtedly would accelerate those studies.

For emergency lighting, Northeast uses two dry-cell units (fastened to bulkheads adjacent to passenger doors) which are manually controlled to illuminate exits.

One of the passenger-witnesses, a World War II bomber pilot, vehemently criticized the emergency exit layout, stating he wanted it entered in the record of the hearings that he thought the exits were too small and too difficult to operate. He had tried to open one of the exits in the dark, he testified, but it became entangled in the curtains. An ALPA representative later stated to the Board investigators that "the opening of an escape hatch should not be dependent upon the sliding back of curtains."

Despite the cabin darkness, there was little confusion among the passengers and evacuation was accomplished in approximately 1½ min., witnesses reported.

The board of inquiry at the two-day hearing consisted of Col. Joseph P. Adams, Everett S. Bosworth (presiding officer), William K. Andrews, Evin N. Townsend, Robert W. Chrisp and Joseph O. Fluet.

Cockpit Setup

- **New instrument panels proposed for transports.**
- **Pilot visibility improved by basic pattern layouts.**

A new standard recommended for cockpit flight-instrument panel arrangement may form the basis for a meeting of minds on this controversial subject between the air transport industry, Civil Aeronautics Board and the military.

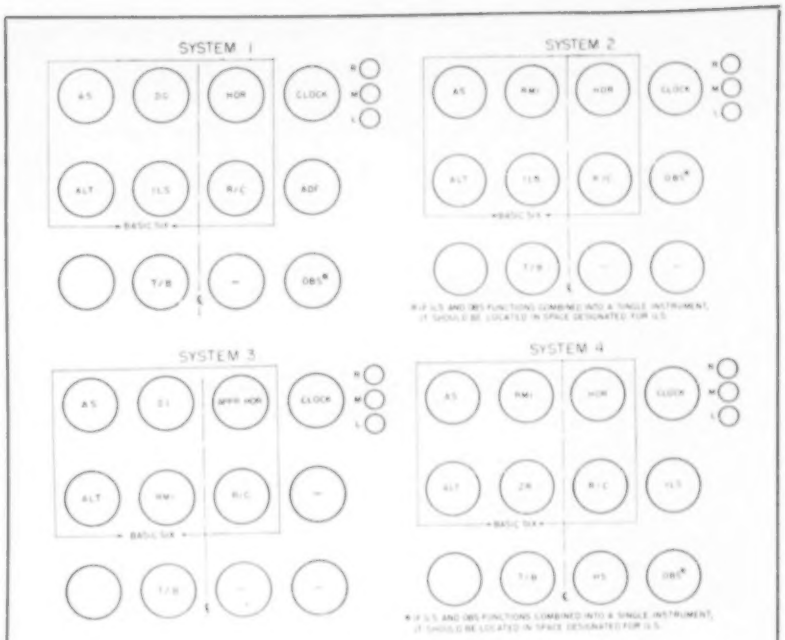
Issued this week by the Society of Automotive Engineers, the recommendation concludes a year and a half of concentrated effort by one of SAE's Committee S-7 subcommittees, headed by M. G. (Dan) Beard of American Airlines. The standard refers to fixed-wing, transport-type aircraft and, as such, does not cover helicopters.

▶**Standard Details**—The SAE standard recommends four separate plans, shown in the accompanying layouts. Systems 1 and 2 are adaptable to transport aircraft employing flight instruments in general use today. Systems 3 and 4 follow the basic pattern of Systems 1 and 2, plus provisions for computer-type units envisioning use of an instrument combining the direction (aircraft heading indicator) and radio automatic direction finder (ADF) functions—a radio magnetic indicator (RMI) that shows the plane's heading and magnetic compass course from the aircraft to the radio station. It was felt this grouping was necessary to arrive at a better all-around standard layout and to conserve instrument panel space.

Four complete panel arrangements shown in Systems 1, 2, 3 and 4 are recommended as standard for the captain's flight panel only. The full panel of 12 instruments is to be located to provide unrestricted visibility of the six basic instruments and, if possible, the auxiliary instruments. If it is impossible to meet this condition, the auxiliary instruments in the bottom row may be relocated horizontally not more than one instrument space away from the position shown.

For the co-pilot's panel, the four arrangements are standard only for the six basic instruments shown. The remaining auxiliary instruments are indicated in a recommended location but may be rearranged for a more functional layout.

Flight instrument panel is to be of sufficient size to accommodate at least 12 standard-size (3¼-in.-diameter) instruments in three horizontal rows of four units each, plus the radio marker beacon lights.



Abbreviations

AS	Airspeed Indicator	**HOR**	Gyro Horizon
APPR. HOR.	Approach Horizon	**HS**	Heading Selector
ADF	Automatic Direction Finder	**OBS**	Omni Bearing Selector
CLOCK	Clock	**ALT**	Pressure Altimeter
CI	Collins Course Indicator	**RMI**	Radio Magnetic Indicator
ILS	Cross Pointer (Instrument Landing System)	**RML**	Radio Marker Lights
DG	Gyro Directional Indicator	**R/C**	Rate of Climb Indicator
		T/B	Turn and Bank Indicator
		ZR	Zero Reader

Centerline of the panel is to be within two inches of the vertical plane passing through the center of the pilot's seat.

▶**How It Developed**—In 1951, CAB issued a tentative directive (later withdrawn) that would require the airlines, at some future date, to follow the Munitions Board's standard on instrument panel layout. Air Transport Assn. didn't look with favor on this approach, mainly because the Munitions Board standard was based on single-seat fighter installations. Further study of the situation was initiated when ATA requested SAE to investigate the problem and recommend a standard.

After SAE's draft-form recommendation was discussed last year, CAB issued another tentative directive calling for flight instrument standards that paralleled, in the main, proposals in the SAE document. Meanwhile, the SAE subcommittee has revised the recommendation to inject a little more leeway in the arrangement in the rows of instruments outside the basic six-instrument grouping.

▶**Unsolved Factors**—While the SAE recommendation offers a possible solution to the problem of flight instrument panel arrangement standardization there are other factors that will have to be ironed out even if the standard is adopted.

One consideration would be when the standard should go into effect with respect to future aircraft. A greater consideration—one that undoubtedly will bring industry resistance—would be whether the standard should be made retroactive, thus affecting existing aircraft. There is some industry feeling the retroactive feature might introduce enough confusion for pilots to offset the projected benefits to be derived from standardization.

The changeover to standard, regardless of how efficiently it would be effected, necessarily would involve a period in which pilots would be working with both old and new arrangements.

▶**Study Scope**—To obtain maximum possible standardization both for civil and military activities, the SAE subcommittee coordinated its efforts with the Munition Board's military cockpit standardization subcommittee. The present SAE standard parallels the corresponding military scheme, except that the SAE plan carries standardiza-

tion further by taking into account future instrument panels—those that would employ flight computers, etc.

During the course of the subcommittee's study, considerable investigation centered on the factor of human physical limitations. Reviewed were motion-picture eye movement studies conducted by both the Civil Aeronautics Administration and the USAF. Subcommittee members, most of whom are pilots and engineers, also flew planes equipped with the new computer-type instruments in the course of their investigations.

► **Participation**—Personnel who participated with Beard on the flight instrument panel standardization study included Capt. Scott Flower (vice-chairman), Pan American World Airways; Glenn H. Brink, American Airlines; M. B. Cahill, Northwest Airlines; C. M. Christenson, United Air Lines; F. E. Davis, Eastern Air Lines; O. R. Haueter, Continental Air Lines; J. B. LeClaire, Transcontinental & Western Air; and H. G. Portman, Air Line Pilots Assn.

The standard is another in the series prepared by SAE on cockpit standardization. Previous documents have covered location and actuation of aircraft controls, cockpit visibility, and instrument and cockpit lighting.

Flying Tiger Salaries, Bonuses Reported

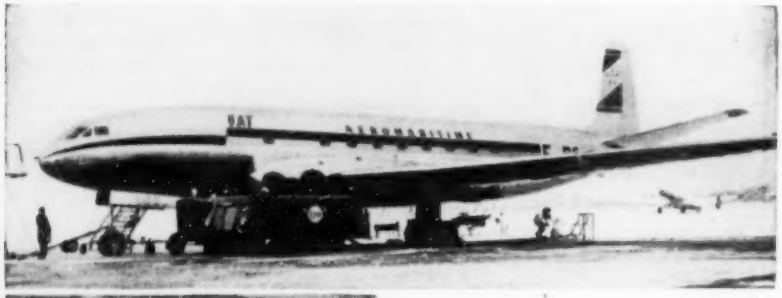
First airline report to Civil Aeronautics Board of salaries and security holdings in 1952 shows Flying Tiger Line salaries and bonuses increased little over a year ago, but a number of officers and directors sold substantial common stock holdings.

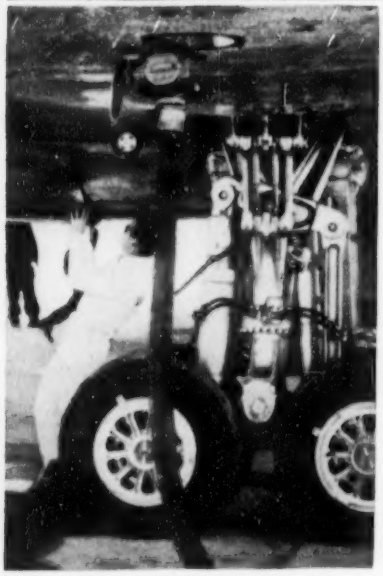
President and director Robert Prescott got bonuses and indirect compensation totaling $8,200 bonus and reduced his common stock holdings from 15,928 to 3,228 shares. Board chairman Samuel Mosher reduced his common stock from 27,970 to 26,895 shares.

Here are reported 1952 compensations and stockholdings of Tiger general officers and directors (1951 figures are shown in parentheses where changes occurred in 1952):

Samuel B. Mosher, chairman of the board, no salary, $1,200 indirect compensation, owns 26,895 shares common (27,970), 818 shares preferred, and has control of $100,000 debentures through control of Signal Oil & Gas Co. which holds these debentures; Robert W. Prescott, president and director, salary $30,000, bonuses and indirect compensation $8,200 (none), owns 3,228 shares common (15,928) and 3 preferred; Fred Benninger, secretary-treasurer, salary $18,000, bonus $6,400, no holdings; W. E. Bartling, vice president, salary $13,200 ($10,700), bonus $3,000 (none), holds 388 shares common (12,488 common and 570 pfd.) and $51,000 debentures (none); George T. Cussen, vice president, salary $9,450 ($8,000), bonus $4,200 (none), holds 100 shares common (200) and 33 preferred; Ralph B. Stump, asst. secy.-treas., salary $10,700 ($9,400); George M. Messinger, asst. secy., salary $8,425.

Directors: Allen T. Chase, salary $3,025, indirect compensation $1,050, holds 2,060 shares common acquired Sept. 2, 1952; James E. Davidson, indirect compensation $750 ($1,350), holds $50,000 debentures (none); Norman L. Meyers, indirect compensation $450 (none) plus equity in $24,000 paid to Meyers & Batzell, legal counsel (none), holds 3,050 shares common and 8 preferred (82); Houston Rehrig, salary $3,025 ($4,500), indirect $900 (none), holds 8,900 shares common (15,730 common and 2,700 pfd.) and $102,000 debentures (none); Robert L. Smith, $1,050 indirect compensation; Thomas J. Sullivan, $3,025 salary ($4,350), 1,350 indirect compensation (none), and holds 1,392 shares common (13,980 common and 2,300 pfd.) and $25,000 debentures (none); William Zeckendorf, no compensation or holdings.





FRENCH COMET REFUELS

Union Aeromaritime de Transport's first DH Comet 1A jet transport at Le Bourget Airport, Paris (above) and at Nouasseur Airport, Casablanca (left), taking on jet fuel from Esso highspeed hydrant systems. The left photo details the underwing fueling point and also the Comet's four-wheel main landing gear. UAT is an independent French carrier operating scheduled service between Paris, North and West Africa and the Middle and Far East. It inaugurated regular jet airliner service between Paris and Dakar via Casablanca Feb. 19. Shown in the photo above is the self-propelled Esso delivery unit utilizing manually controlled hoses for either under-or overwing fueling. Dispenser can be fitted with pumps either to boost pressure in a pressure-type hydrant system or to provide pressure in a gravity-feed installation. UAT is scheduled to get two additional Comet 1As.

Airline Tax Benefits Broadened by ODM

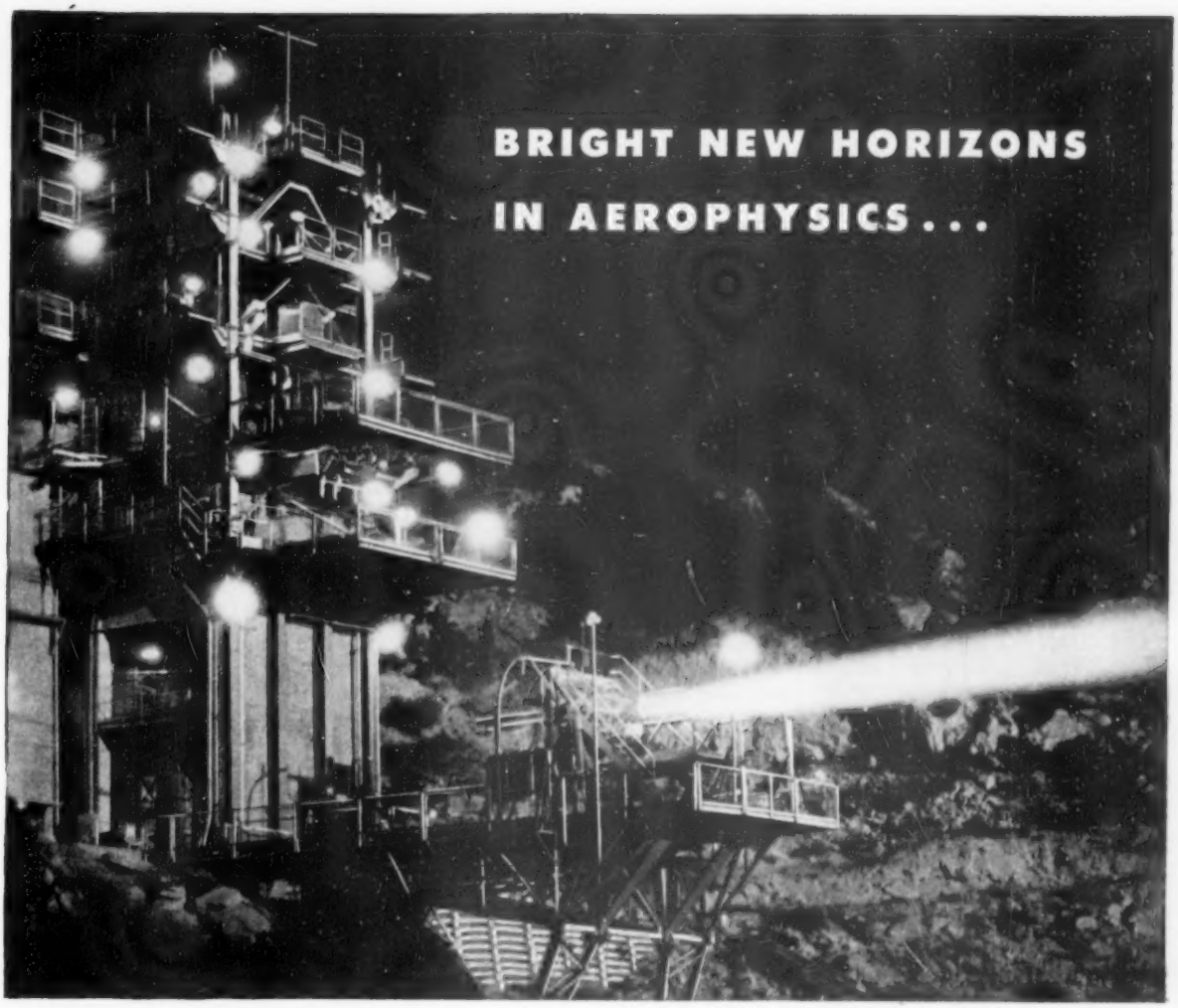
Office of Defense Mobilization has broadened airlines' opportunity to get accelerated tax amortization on a total of 600 planes delivered in the mobilization period. ODM has lengthened the period of eligibility for the tax benefit by almost two years.

For planes delivered during the target period, ODM permits a five-year write-off instead of the normal seven years allowed by Bureau of Internal Revenue.

► **Realistic Goal**—The new ODM ruling permits rapid writeoff of airliners delivered within the five and a half years from Jan. 1, 1950, to June 30, 1955. The original ODM goal, set about a year ago, was 600 new transport deliveries from Apr. 1, 1951, to Dec. 31, 1954. Approximately 300 planes have been delivered so far, and an additional 60 are certificated but have not been delivered.

Despite huge airline capital commitments for these orders, it did not appear that the 600-plane goal would be attained within the original period. The new time-extension appears to make the 600-plane goal more realistic.

► **War Mobilization**—Airlines accepting



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the rapid tax writeoff privilege must fulfill their side of the bargain by making the planes available for military use in the event of full war mobilization.

The four-engine aircraft must be modified to be ready for 48-hour transfer to overseas military transport service. Most airlines still are negotiating with Air Materiel Command on terms of these long-range modifications.

Report Says CAB Is Strangling Nonskeds

Civil Aeronautics Board is charged by the Senate Small Business Committee's annual report with inflicting "death by delay" and "strangulation by regulation" on the nonscheduled air transport industry. The report was filed just prior to the Board's appearance before the committee.

The committee has requested CAB to testify Mar. 20 on steps it has taken to consolidate nonsked airlines in the transportation system.

The committee also lashed at the Board for alleged failure to promote international airfreight service.

Highlights of the report:

• "This past year saw a stepping-up on the war of attrition against the small business segment of the aviation industry by CAB. CAB action against the irregular airlines, who were the originators of low-cost aircoach, took a number of forms, ranging from mild harassment to outright elimination of some of the carriers."

• Decisions by CAB adverse to the nonskeds included "refusal of the Board to reconsider its denial . . . of a certificate of public convenience and necessity for all-coach transcontinental service and an attempt by the Board to obtain authority from Congress to impose severe financial penalties for violations of CAB economic regulations."

• If CAB's study of the role of nonskeds in air transportation drags on for another two years, "some of the nonskeds have protested that by the time it is completed all of them may already have been eliminated by CAB, thus defeating the purpose of the study."

• "CAB, at the request of the President, recently agreed to reconsider its recommendations in the trans-Atlantic freight case against certifying all-cargo service across the North Atlantic. Instead of reaching a decision promptly, as the President apparently envisioned, CAB has ruled that the proceedings must be an entirely new case, which may take years to decide. American carriers already lag far behind foreign carriers in the international freight field. By the time a decision is reached by CAB, even should it be favorable to certification, it may be too late for the U.S. to overcome the handicap."

CPA Comet Crash Causes Are Sought

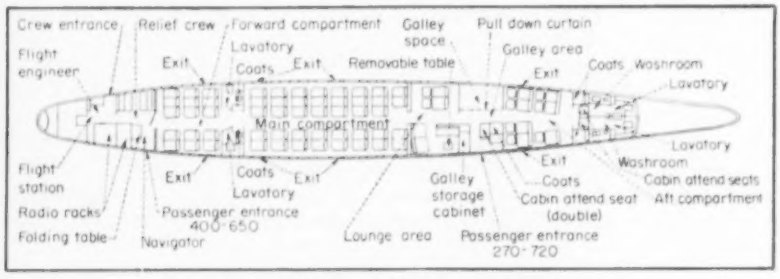
(McGraw-Hill World News)

Karachi—Markings on the runway at Karachi Airport indicate that the Canadian Pacific Airlines' DH Comet 1A, which crashed here Mar. 3, may have developed an excessive nose-up attitude during takeoff, resulting in high drag and semi-stalled condition preventing it from becoming airborne.

If so, the circumstances would almost duplicate the earlier crash of a BOAC Comet 1 at Ciampino Airport, Rome, Oct. 26 (see AVIATION WEEK Jan. 19, pp. 58-72 for official investigation report).

Eyewitnesses of the Karachi crash say runway markings make it appear that the jet airliner's tailskid had scraped along the strip.

Tire marks there indicate that the pilot unsuccessfully attempted to brake the aircraft, which tore through a barbed wire fence at the edge of the run-



TCA SUPER CONNIE SEATING

Here is how Trans-Canada Air Lines is planning seating for the eight Lockheed Super Constellations it will put into trans-Atlantic service in 1954. The planes will have 54 tourist-class and nine first-class chairs. Here is the breakdown of the cabin's four main sections: 15 tourist seats in forward compartment, 39 tourist in main section, two first-class seats in the lounge and seven first-class in the aft compartment. There also are four washrooms. Note provision for relief-crew quarters up front.

way, plunged into a deep ditch and burned completely, killing all 11 persons aboard.

Intensity of the fire, which completely destroyed the plane made a detailed investigation of the wreckage difficult. The Comet 1A reportedly was loaded with 56,000 lb. of fuel.

Five of the men aboard were Canadian Pacific Airlines' crew members; the remaining six were British technicians, including five de Havilland Comet experts (AVIATION WEEK Mar. 9, p. 17). Three de Havilland officials, chief test pilot John Cunningham, Peter Mouritz of the DH Engine Co.; and Peter Detmold of the Comet servicing organization flew to Karachi aboard a BOAC Comet to aid in the official investigation.

SHORTLINES

► **Air France** passenger-miles gained 16% in 1952 to 928,276,900, and freight ton-miles climbed 22% to 34,486,800—with the same fleet as 1951. This year, company will commission Turbo Compound Super Constellations for long-range flights and jet de Havilland Comets and turboprop Vickers Viscounts for medium and short hauls.

► **Allegheny Airlines** passenger revenues last month of $115,809 compare with $79,889 of a year ago, while scheduled mileage flown dropped 9,000 mi. February traffic and the company's profit the last half of 1952 indicate a "good year," Allegheny says.

► **Avianca**, Colombian National Airways, plans daily service to New York starting in April, compared with current service of four flights a week. . . . Company also starts flights from Bogota to Hamburg and Frankfurt, Germany, Apr. 10.

► **Braniff Airways** application for nonstop Tulsa-Dallas service has been deferred by Civil Aeronautics Board for consideration with a similar Continental Air Lines case.

► **British European Airways** helicopter unit rescued 76 persons during the recent Holland flood disaster, carried 44 doctors, and supplied two tons of medical and other supplies in 45 hr. flying time.

► **British Commonwealth Pacific Airlines** may be first carrier to span the Pacific with jet transport equipment. Canadian Pacific Airline's Comet 1A was scheduled to start this spring, but the Karachi crash reduces the company to only one such type until delivery of Comet 2s. BCPA plans Pacific service with Comet 2s, which are ordered for late 1954 delivery.

► **British Overseas Airways** seeks improvement of Nassau's Oakes Field airport. BOAC board chairman, Sir Miles Thomas, says its present "substandard" condition would hamper jet service. . . . Company plans to investigate weather characteristics at 40,000 ft. over the Atlantic with Comet 2 jets in 1954 before operating them New York-Nassau-Jamaica-Bermuda.

► **Civil Aeronautics Administration** on Mar. 16 added a new communications guard channel, 3023.5 kc, and dropped the military guard channel, 4495 kc. CAA also plans to drop the time-honored 3105-kc guard channel a year from now. CAA says the new 3023.5 kc is a step in a worldwide program to rearrange the high-frequency spectrum and gives more freedom from tropical static. . . . The administration has asked that the personnel-hiring "freeze" by President Eisenhower be waived for airways operation specialists, (including communicators and traffic controllers) and electronics maintenance personnel. "Essential" jobs do not come under the recent administrative "freeze." Total CAA personnel turnover averages about 2% per month.

► **Colonial Airlines** domestic Canadian and Bermuda passenger traffic in January increased 30% and 43%, respectively, compared to a year ago.

► **Eastern Air Lines** has installed an automatic telephone exchange at the Miami maintenance base, linking offices, dock areas, runup positions, etc. On-time performance is expected to benefit most, but direct cost savings are anticipated, too, through increased maintenance efficiency.

► **International Civil Aviation Organization** will meet July 8 at Brighton, England, to continue the present agreement that maintains 25 ships on North Atlantic weather patrol.

► **Oakland Municipal Airport** $10-million general obligation bond goes to public vote Apr. 21.

► **Pan American World Airways** has signed a wage contract giving increases of 10 to 11 cents an hour to ground personnel and about $30 a month to flight service personnel. Some 5,000 workers are affected by the two-year contract. . . . Company's 28 Stratocruisers have flown more than half a million passengers since introduction Apr. 1, 1949. PAA now operates 118 passenger transports altogether—including Constellations, DC-6Bs and Convairs.

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62	CQ-9	Eclipse	Clutch Switch (PB10)
11	12086-1C	Eclipse	Amplifier
19	15100-1B-A1	Eclipse	Pitch Trim Gauge
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9	20100-42B-14A2	Eclipse	Torque Ind.
9	20000-8A-14	Eclipse	Magnesyn Pos. Ind
23	20100-11C-4-A1	Eclipse	Wing Flap Indicator
11	DW-33	Eclipse	Transformer
23	CQ-2	Eclipse	Switch Box
75	1195-4-A	Eclipse	Vibrator
80	DW-28	Eclipse	Transformer
11	2227-11-D3A	Eclipse	Tachometer
75	1416-12E	Eclipse	Starter
100	716-3A	Eclipse	Generator (NEA-3A)
384	564-2A	Eclipse	Oil Seperator
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40	119862	Weston	Carb. Air Temp. Indicator
400	AN5780-2	Weston	Wheel & Flap Position Indicator
1000	AN5780-2	G.E.	Wheel & Flap Position Indicator
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11	727TY70Z2	Weston	Air Temp. Ind.
85	727TY72Z2	Weston	Air Temp. Gauge
88	727TY73Z2	Weston	Air Temp. Gauge
83	727TY74Z2	Weston	Air Temp. Gauge
10	728-40Z2	Weston	Air Temp. Gauge
21	8DJ29AAY	G.E.	Cowl Flap Ind.
22	77C5	Lewis	Carb. Air Temp.
16	76B19	Lewis	Cyl. Head Temp.
23	77C3	Lewis	Oil Temp. Gauge
13	77C4	Lewis	Oil Temp. Ind.
30	47B21	Lewis	Free Air Temp.
33	47B22	Lewis	Air Temp. Gauge
28	47B23	Lewis	Air Temp. Gauge
54	47B24	Lewis	Air Temp. Gauge
22	906-6-011	Kollsman	Diff. Press. Gauge
48	254BK-6-052	Kollsman	Diff. Press. Gauge
33	DW-47	Eclipse	Transformer
46	117-47	Edison	Fire Detecter
19	117-10	Edison	Control Box
345	981280	Kidde	CO2 Cylinders
43	966090	Kidde	Interconnector
104	966679	Kidde	Pressure Control
225	981591	Kidde	Tee
151	A-4614	Kidde	Switch
47	M870036B	Kidde	CO2 Cyl.
74	923748	Kidde	Oxygen Cyl.
326	982585	Kidde	Valve
325	AN60009-1B	Oh. Chem.	Valve
247	AN6009-2A	Oh. Chem.	Valve
47	2-1046-76	Parker	Valve (3000 PSI)
115	P4CA2A	Parker	Primer
68	SP4-2746-77	Parker	Restrictor Valve
105	SP4-2746-78	Parker	Restrictor Valve
68	6-746-10	Parker	Valve
40	SP4-2746-79	Parker	Restrictor Valve
48	SP-2746-80	Parker	Restrictor Valve
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112	PLY-843-54	Parker	Check Valve
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327	PF4-713-20BCE	Vickers	Hydraulic Pump
57	MF45-3911-90Z	Vickers	Hydraulic Pump (3000 PSI)
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250	AN4014	Erie Meter	Wobble (D-3) Pump
45	AN4103-2	Clifford	Brass (Valve #U4785) Oil Cooler
70	AN3213-1	Scintilla	Ignition Switch
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66	M862A	Jos. Pollack	Master Switch
148	PG208AS1	Honeywell	Switch Air Ram.
40	PG208AS7	Honeywell	Air Ram Switch
18	4582-AA-6C	Dynamic Air Eng.	Blower
24	U-702-15	Joy Mfg. Co.	Blower
20	V301B7	Aerotec	Pressure Relief Valve
419	450	Skinner	Filter
287	1033-4E1	White-Rodgers	Heater Control Switch
126	17322-2	Fenwall	Thermo-Switch
34	98048	Vapor Car Heating Co.	Control Box
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46	146102	Bendix	Valve (0-500 PSI)
240	1265-900	Airex	Relief Valve
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53	AN6203-3	Bendix	Accumulator 10"-1500 P.S.I.
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140	K14949E	Marquette	Windshield Wiper Kit
188	EYLC-2334	Barber-Coleman	Control
230	921-B	Stewart-Warner	Heater (200000 BTU)
22	0655-D	Aro	Oxygen Regulator
65	ASDC2	CO2 Mfg. Co.	Fire Detector
97	6041-H-146A	Cutler Hammer	Relay (B-12)
237	6141-H69A	Cutler Hammer	Circuit Breaker
47	7264-404	Leach	Relay
22	M-2031	Air Associates	Actuator
11	FYLD2516	Barber Colman	Thermostat
51	AYLZ2284	Barber Colman	Micropositioner
20	72400	Hem. Stand.	Prop. Reversing Control
10	5X18	Woodward	Governor
46	A14-A-9708P	Westinghouse	Contactor
26	70G3	G.E.	Transformer
718	B2A	Square D	Relay
6	83A94	Surface Com-bustion Co.	Heater
115	C6363-1-5A	Spencer	Circuit Breaker
115	C6363-1-2A	Spencer	Circuit Breaker
33	18784	Adel	Restrictor Valve
1700	AM1614-80	Heinemann	Circuit Breaker
31	BOBX-2	Allied	Relay
85	12924-2	Adel	Lock Valve
805	58G926	G.E.	Ballast Core & Coil
140	58G946	G.E.	Ballast
40	7210-24	Leach	Relay
66	25432	Airesearch	Flex. Cable
518	MT48C	Bendix Radio	Insulator
20	M-101-B	Aerotec	Pressure Switch
12	MT68EG	Bendix Radio	Mount
52	715E	Fulton Syphon	Temp. Control
478	D9530	Adel	Selector Valve
668	D9530-2	Adel	Selector Valve
428	D9560-2	Adel	Selector Valve
179	D9632	Adel	Selector Valve
237	D9696	Adel	Selector Valve
744	D10044	Adel	Selector Valve
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814	74247 (TY. PH3)	Aero Supply	Valve
335	AN5830-1	Whittaker	Valve
74	AN5830-6	Whittaker	Valve
60	AN5831-1	Parker	Valve
65	1011-2	Eclipse	De-icer Valve
130	612-4A	Eclipse	Valve
2200	37D6210 (AN4078-1)	United	Solenoid Valve
1888	K1593-6D	Kohler	Valve
500	NF3-5	Mallory	Noise Filter
20	TA-12B	Bendix Radio	Transmitter
35	RA10-DB	Bendix Radio	Receiver
2585	AN3096-4	Grimes	Dome Light
775	AN3096-5	Grimes	Dome Light
1365	AN3096-6	Grimes	Dome Light
6	610-2C	Eclipse	Vacuum Pump
550	PD12K10	Stromberg	Carburetor
236	PR48-A1	Stromberg	Carburetor
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130	82B8	P & W	Follower Ass'y.
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75	48363	P & W	Shaft
56	48392	P & W	Sump
390	48461	P & W	Gear
78	76236	P & W	Gear
1178	84282	P & W	Bearing
113	84487	P & W	Housing
77	84591C	P & W	Nose Housing
200	84350-D	P & W	Crankcase Ass'y.
200	84083	P & W	Cylinder
100	84084	P & W	Cylinder
200	84085	P & W	Cylinder
281	CR2791-G100-K4	G.E.	Relay
626	CR2792F101-A3	G.E.	Relay
41	G34464	Guardian	Relay
350	G31502-A	Guardian	Relay
22	146102	Vickers	Brake Valve
9	557-5	Eclipse	Check Valve
6	TFD-6500	Thompson	Pump
107	D12296	Adel	Pump
67	19100-2-101B	Kenyon	Check Valve
88	3135-11C	Eclipse	Pressure Switch
32	3V-217-HC	Pesco	Separator
100	27314	Purolator	Oil Filter
128	3801-3B	Eclipse	Fuel Quan. Gauge
33	420313	Wright Aero	Pump Assy.
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12	U8416-MM	U.A.P.	Oil Cooler Assy.
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35	AA14002A	Vickers	Accumulato
21	FD65-5	Diehl	Motor
81	3616	Bendix Radio	Control
23	3620	Bendix Radio	Station Box
17	C-8(B-2930-A)	Grimes	Cockpit Light
335	G1 (94-32376)	G.E.	Oxygen Pressure Signal Assy.
180	AW-CV-1-1	U. S. Gauge	Check Valve
740	1C-200	G.E.	Radio Noise Filter
15	1EAR-280BH	Pesco	Pump
7	SP-1-445-8	Parker	Selector Valve
8	1E621	Pesco	Pump
29	NEP-2	Eclipse	Auxiliary Power Unit
16	LER-30D	Lawrence	Auxiliary Power Unit
4	2CM46A2	G.E.	Generator
6	2P248EB	Pesco	Fuel Pump
21	2E258SA	Pesco	Pump
146	AW2-3/4-25K	U. S. Gauge	Manifold Press Gauge (Metric)
27363	CREB3N	Cesco	Rod End
18	SA/3A	Kidde	Impact Switch
13	3GBD1A18A	G.E.	Regulator
18273	AN200-K3L9	Fafnir	Bearing
245	LMR-4	Micro	Switch
2094	PM-5	Spencer	Circuit Breaker
44	5BA25D-J4B	G.E.	Motor
31	5AM31JJ9A	G.E.	Amplidyne
111	5AM31NJ10	G.E.	Amplidyne
425	5BA40NJ1A	G.E.	Motor
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298	727-TY37P	Weston	Air Temp. Ind.
2000	8909-K99	C. H.	Switch
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402	NAF310310-5B	Cannon	Plug
132	AN6209-8	Hydro Aire	Valve
50	AN6213-2	Bendix	Hyd. Valve
280	AN6220-4	Aeroquip	Coupling
27	AN6247-2	Adel	Hyd. Valve
14	UA8013-MM	United Aircraft Prod.	Oil Cooler
1175	RS-2	Mallory	Selector Box
172	A7012	Delco	Motor
6	8DJ13ABK	G.E.	Tachometer Indicator
200	2222-1F-2A	Eclipse	Tachometer Indicator
28	AN5770-2	Manning Maxwell Moore	Manifold Pressure Gauge
71	1003-4	Eclipse	Generator
427	NAF1016-1	Adams & Westlake	Light Ass'y.
616	NAF1016-2	Adams & Westlake	Light Ass'y.
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COCKPIT VIEWPOINT

By Capt. R. C. Robson

More Reliability Needed—Part 1

Reliability is still a serious problem in air transportation because the average person regards the airplane in nearly the same light as the telegram—to be used only under certain circumstances. Reliability, as we use it here, does not relate to engine failure, fire or crashes and the like. This problem concerns the 11:15 flight which arrives promptly at 2:30, or the Pittsburgh plane which finally lands—at Cleveland. Though our present-day percentage of "irregular operations" is small, it can and should be reduced still further.

One big headache lies with our U. S. doctrines of weather flying. Here is an art which can be said to have been conquered in practice but not in theory—a distinct switch from usual procedure. To be blunt about an old theme in this column, we are operating under an untenable theory of weather minimums which legally prevent many operations that otherwise could safely be accomplished.

► **Ceiliometer Peep Show**—For those new to the subject, two facts must be made clear. First, it has been proved many ways at many times that we cannot measure ceilings accurately closer than several hundred feet. Second, when this arbitrary observation says "below limits," a scheduled flight has no alternative but to go elsewhere or remain at cruising altitude.

Obviously, this is a strange way to conduct a multi-billion-dollar business. But the lawmakers keep insisting that this mystical number obtained during a ceiliometer peep show has some connection with safety. In effect, when this number falls below a reference figure the law says to the pilot: "Son, we no longer trust you or your skills; go away."

► **Misleading Reports**—Since this is the same pilot who was trusted to make the takeoff, maintain a safe cruising altitude, slow down in turbulence, use deicers when needed, make an instrument approach, pull up when the weather is worse than reported, and trusted in a thousand other ways, it is difficult to see the justification for a sudden change at one particular point.

The adherants of this foolish law say that allowing the pilot to take a "look-see" will encourage cheating; that is, fly too low, determined to land at all costs. So the law will not let the pilot come near the airport.

Let's examine this reasoning. First, every scheduled airline pilot in the country has had more than one wild ride under the present rule because of misleading weather reports. Second, the law already credits the pilot with the good judgment to pull up when he finds weather below safe limits. So actually nothing will be changed by allowing a "look-see."

That last sentence is not strictly accurate, of course. One thing will change: Reliability in air transportation will increase by a considerable amount.

► **Practical Measurement**—Landing an airplane under poor weather conditions is mainly a function of how far the pilot can see. The observation that would be of most benefit is a visability measurement from the end of the runway in the direction in which the landing is being made. This would not only be of practical value to the pilot but could also serve as a legal limit.

It should be stated here and now that aviation needs all the weather information it can get, with as much accuracy as possible. And this is not meant to slur the U. S. Weather Bureau, for they are doing the best they can and simply following regulations made by others. In the interests of reliability to promote the growth of air travel, it is high time these "others" recognized the shortcomings of present regulations and inquired into more modern methods of doing the job.

Next week we will delve into a more modern method.

AVIATION CALENDAR

Mar. 16-20—SAE semi-annual meeting of aeronautical materials specification group. Stoneleigh Hotel, Dallas, Tex.

Mar. 17-19—21st National Meeting American Meteorological Society, Chalfonte Haddon Hall, Atlantic City, N. J.

Mar. 17-20—21st Annual Meeting, American Society of Tool Engineers, Hotel Statler, Detroit.

Mar. 23-25—Third Midwestern Conference on Fluid Mechanics, University of Minnesota, Minneapolis.

Mar. 23-26—Institute of Radio Engineers National Convention, Waldorf-Astoria and Grand Central Palace, New York, N. Y.

Mar. 23-27—Eighth Western Metal Exposition and Congress, Pan-Pacific Auditorium, Los Angeles.

Mar. 23-28—Congress of Civil Aviation Conference, a joint meeting of trade organizations; Theme: 50 years of aviation progress. Airport Operators Council and American Assn. of Airport Executives are holding annual meetings simultaneously. Kansas City, Mo.

Mar. 25-27—National Production Forum of the SAE, Hotel Statler, Cleveland, O.

Mar. 31-Apr. 2—First International Magnesium Exposition, National Guard Armory, Washington, D. C.

Apr. 20-23—Aeronautic Production Forum, National Aeronautic Meeting and Aircraft Engineering display (SAE), Hotel Governor Clinton and Hotel Statler, New York, N. Y.

Apr. 20-May 2—Annual Conference of Technical Committee, International Air Transport Assn., Caribe Hilton Hotel, San Juan, Puerto Rico. Helicopter Symposium will be a principal feature.

Apr. 25-May 2—First annual National Transcontinental Handicap Air Cruise for private planes of 300 hp. or less, Philadelphia to Palm Springs, Calif., sponsored by Philadelphia Junior Chamber of Commerce.

Apr. 29-May 1—1953 Electronics Components Symposium (AIEE-IRE), Shakespeare Club, Pasadena, Calif.

May 6-7—Second annual Skylady Derby, sponsored by Women's National Aeronautical Assn., sanctioned by NAA and conducted under FAI rules. From Fort Smith, Ark., to Memphis, St. Louis, Kansas City and return to Fort Smith. WNAA's twenty-fourth annual convention will follow at Fort Smith.

May 11-13—National Conference on Airborne Electronics, Dayton Biltmore Hotel, Dayton, O.

May 16—Armed Forces Day, open house programs at local USAF, Navy, Army, Marine and Coast Guard installations.

Sept. 7-13—1953 SBAC Coronation Year Flying Display, Farnborough, Hampshire, England.

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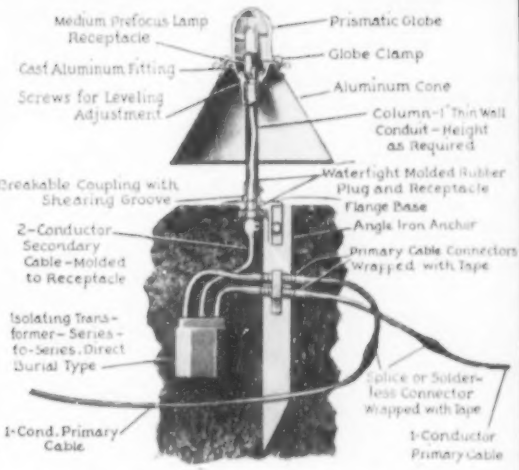
Elevated Runway and Taxi Light with mountings to meet YOUR requirements

Crouse-Hinds type ERL Elevated Marker Light with transformer housing

CAA Approved

Specifications L-802 and L-822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Style A Mounting, as illustrated above, consists of surface flange and 30-inch anchor stake, with a direct earth burial type transformer. This provides the simplest and most economical installation.

Style B Mounting is illustrated in the assembled view at the left. It consists of a base plate and gasket to fit transformer base housings. It is used for converting existing flush marker light fixtures to ERL fixtures or for new installations at large airports or wherever a first-class wiring installation is desired. This mounting provides maximum accessibility of the transformers and connections and will save considerable time in case of wiring difficulties.

Style C Mounting is for multiple circuits and consists of a junction box with a hub cover on top, two squeeze connectors for through-feed cables at the bottom, and a 30-inch angle iron anchor. This mounting is especially useful for short runways and for taxiway lighting.

Style D Mounting consists of an integral cast Feraloy base housing and transformer complete with anchor stake.

Crouse-Hinds Elevated Marker Light can be furnished in any height from 17 to 30 inches, as required for local conditions. Either symmetric or asymmetric light distribution can be furnished. The globe is clear for runway lights, green for threshold lights, or blue for taxi lights. A breakable aluminum coupling is at the bottom of the mounting column. It is designed to withstand high winds and propeller blasts but will break readily upon impact.

This marker light is one of the hundreds of items in Crouse-Hinds complete line of airport lighting and control equipment. Write for full details on the equipment you require, whether it is a single unit or a complete airport installation.

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LETTERS

Pilots & Experience

Captain Robson's column "Cockpit Viewpoint" is one of the most practical and interesting aviation columns I read. However, in his column in your Feb. 23 issue, in discussing the Air Force crashes, he is no doubt correct that experience in the command pilot and lack of ability to assist from the co-pilot are major factors in these crashes. He neglects, completely, however, other pertinent factors such as training and ability and doesn't suggest any useful method of obtaining experience.

Another consideration might be navigational equipment available to the pilot, which in all probability is not equal to that of the airlines or executive pilot.

J. H. Zerbey, III
General Manager & Managing Editor
Pottsville Republican
Pottsville, Penn.

(Capt. Robson's point was whether pilots with the most experience should not be assigned to flights carrying as many as 80 or more men on transport flights—Ed.)

Captain R. C. Robson's Cockpit Viewpoint article (Feb. 23) criticising USAF policy of permitting low total time pilots to command heavy passenger carrying aircraft has no doubt by this time caused a wave of protest, to which I am going to add my two cents worth.

Capt. Robson's derision of the 2500 hour heavy aircraft pilot is not consistent with the past history of the aviation industry. USAF accidents are due perhaps to low pilot proficiency and lack of supervision but certainly not in itself to low total pilot time.

A close relationship with an ATC airline operation, utilizing sixty C-46 type aircraft, 24 hour schedule, considerable instrument weather, inadequate radio facilities, questionable maintenance, numerous engine failures and emergency incidents, overloaded airplanes, and a 12 month safety record unsurpassed anywhere, prompt me to make this statement.

All this with quite a few not 2500 hour pilots but 1000 hour pilots, practice, practice, practice and a little mental thing called attitude—impressing on the youngster his responsibility as an airline pilot, that there are no shortcuts to the right way, that minimums are just that and that many an "experienced" old timer would still be around if he hadn't sneaked that extra 100 feet.

Captain Robson has a short memory. He should investigate the background of his own airline captains. I am sure he will discover that they were not born with 20,000 hours in the book. He may even find a few who at one time did not possess the scorned 2500 hours when they were full fledged captains in command of a load of women and children even though their qualifications were "fantastically inadequate."

Captain Robson's memory is indeed short when he speaks of 2500 hours as a mere introduction to the newer and heavier equipment. He forgets the moment when he was roaring down the runway in a new airplane with his trusting human cargo, with hour number one of scheduled flight still to be placed under his belt. He forgets he was part of a not too impressive operation for about three years until he was properly introduced to his equipment.

The scheduled airline accident record does not seem to indicate a ratio of experience level to accident occurrence. Perhaps a 2500 hour man in the Convair at Memphis, who has been drilled and drilled on the proper airspeeds and flap settings for engine failure on takeoff would have made it around. And who can say that the 20,000 hour man could have saved the Convair at Newark? Is the junior captain, who on a five hour local run, makes half a dozen landings and maybe as many instrument approaches, less proficient and less safe than the 20,000 hour man on an ocean run who watches an autopilot hold a heading for 10 hours.

Based on present industry standards the latter obtains twice the experience trip for trip. Pilot proficiency is not a product of total hours in the air but of recent and concentrated practice. The 20,000 hour man is usually assigned to the heavier equipment not because he can operate it more safely than his junior captain but because he has more seniority and is entitled to a softer berth.

It takes about 25 years for a pilot to acquire 20,000 hours of airline time, placing these pilots close to 50 years of age. To state that a 50-year-old reflex and nervous system is the equal of a 25-year-old would be incorrect. The older pilot acquires a seasoning and judgment that, combined with proper attitude, lets him realize that he is slowing down, that his proficiency is deteriorating and he makes allowances accordingly.

But the fact remains that pilot proficiency is still the greatest human factor in safe aircraft operation. The airlines seem to be missing a bet in that the wise old owl, aboard in a position of authority but not necessarily pushing the knobs, would be a healthy situation.

I, myself, am an airline transport rated corporation pilot; 16 years and 7000 hours, a junior birdman to be sure, but nonetheless I firmly believe the USAF 2500 hour pilots, properly trained, indoctrinated and regulated, can conduct an airline operation anywhere in the world with any size equipment, and with equal or better safety records than the airlines of today, who are hampered by outmoded practices and prejudices.

Mark H. Houston
6520 Craigland Court
Cincinnati 30, Ohio

Flying & Safety

It seems to me that your writer on aviation safety Jan. 12 is looking at the relationship between the amount of flying and the number of accidents in the Air Force from the wrong approach.

He seems constantly surprised in the article that the number of accidents (based on 100,000 hr.) goes down as the amount of flying increases, or goes up as the flying decreases.

It seems to me this is quite a natural phenomenon which would accompany the skill of flying. An increase in the total amount of flying done by the Air Force would indicate a somewhat proportional increase in the flying per pilot. I believe anyone connected with flying will admit that the more flying a person does, the less apt he is to have an accident when reckoned on a "per unit" basis.

During the 1946 demobilization period, flying dropped to a little over four hours per month for thousands of rated officers. The inevitable result was a very high accident rate. As flying time became more available the last five years, proficiency again picked up and the accident rate declined.

Among airline personnel, the accident rate is the lowest in existence; and the flying is a steady 900 hr. per year per pilot. The constant application of the individual's skill keeps proficiency on a high level and the accident rate at a bare minimum.

Lyle H. Gildermaster, Co-Pilot
Chicago & Southern Air Lines
548 Carol Drive
New Orleans, La.

Garuda's Repair Base

With reference to Aviation Week, Dec. 8, p. 88 and Dec. 15, p. 14, I have had the pleasure of visiting Indonesia several times and was assigned to Garuda Indonesian Airways, N. V., for their first year of Convair-Liner operation.

I'm afraid your correspondent in Melbourne is too far removed from the scene to get all his facts straight. Garuda has an excellent, well staffed maintenance base at Djakarta; and it is not true, as stated in your Dec. 8 issue, that "most of its planes are sent to Australia when they need extensive overhaul or repairs."

Shame on you for headlining the Dec. 15 story, "Indian Airport Plans." "Indian" is not an abbreviation nor a nickname for the Republic of Indonesia.

Henry M. Bohmbach
Field Service Engineer
Consolidated Vultee Aircraft Corp.
c/o Hawaiian Airlines Ltd.
Honolulu, T. H.

Praise

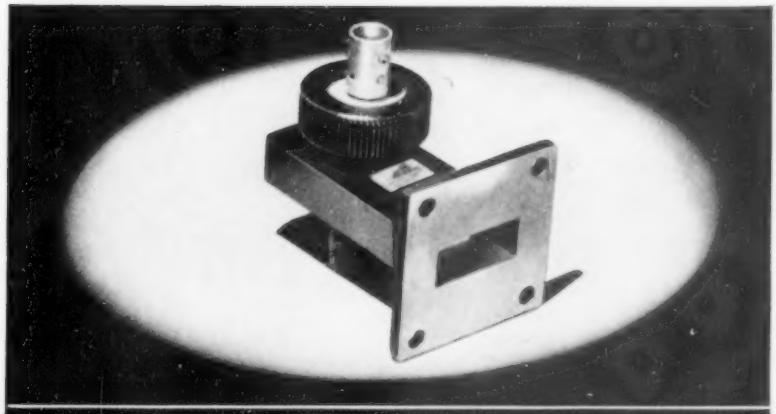
. . . Aviation Week is a standard reference and information source for those members of our engineering staff who are working on a variety of problems in the aeronautical sciences. Typical problems include development of a highspeed null-balance tachometer, studies of aircraft flutter and vibration, design and construction of special environmental test equipment, and applied studies in aerodynamic theory.

Marvin Hammer
Midwest Research Institute
4049 Pennsylvania
Kansas City 2, Missouri

New X-Band Test Equipment

ADDITIONAL INSTRUMENTS

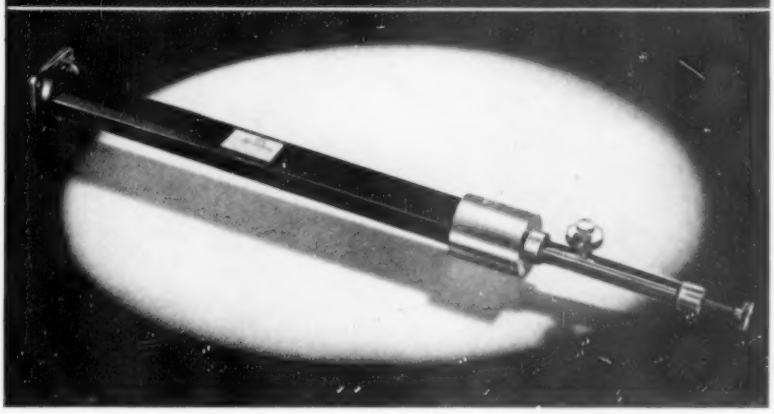
ADDED TO MICROLINE*



Model 219C Waveguide Thermistor Mount

This instrument is used in conjunction with accessory equipment to measure and monitor microwave power at average power levels as low as 10 microwatts. It is particularly useful in the measurement of pulsed power. This thermistor mount is recommended for use with the Microline Model 123B Wattmeter Bridge.

Frequency Range	8.5 – 9.6 kmc.
Maximum VSWR	1.5
Operating Resistance	135 ohms
Maximum Power Rating	10 mw.
Waveguide Size	RG-52/U (1" x ½")



Model 495 Adjustable Termination

This instrument is specially adapted for use in precise microwave measurements where the quality of excellent impedance matching over a broad band is essential. The design of Model 495 provides for independent control of phase and amplitude of the reflection coefficient of the load. It is particularly useful in applications requiring a termination of minimum power reflection, a movable termination where the reflection from the termination can cause error in measurements, or as a means of matching low standing wave ratios to obtain the smallest possible reflections.

Frequency Range	8.1 – 12.4 kmc.
VSWR Range	1.005 – 1.15
Phase Variation	360°
Waveguide Size	RG-52/U (1" x ½")
Power Rating	5w.

Our nearest district office will be glad to supply complete information upon request.

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MODEL	INSTRUMENT
167A, 486A	Adapter
377	Adjustable Short
173, 174, 183 152A, 134A	Attenuator
184	Barretter Mount
170, 171	Waveguide Bends
360A	Detecting Section
234, 235, 236	Directional Coupler
126, 273	Frequency Meter
145	Impedance Meter
379	Mixer
165A, 166A	Waveguide Tee
406	Magic Tee
150, 246	Termination
146, 178	Transformer

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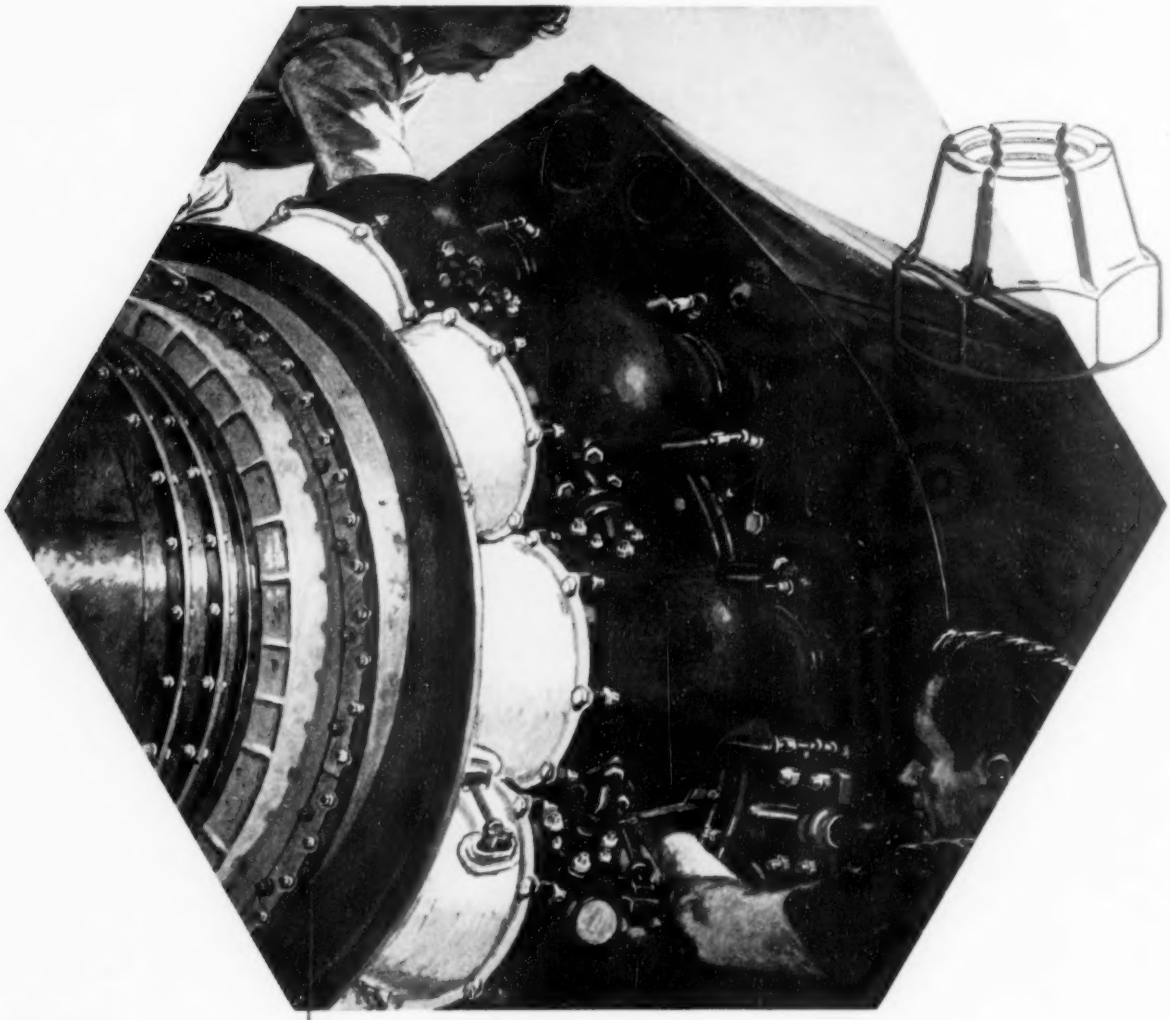

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